

67 MAY 20 1922

CONTRACTORS' & ENGINEERS' MONTHLY

A Purchasing Guide for Engineers, Contractors, Public
Officials and Other Buyers of Construction Equipment.

UNIVERSAL^{CAST IRON} PIPE *in* Detroit MICHIGAN



64,000 FEET
OF 12-INCH AND 16-INCH

'Universal' Cast Iron Pipe
for the City's Water Supply

WRITE NEAREST OFFICE FOR WATER
SUPPLY AND FIRE PROTECTION DATA.

THE CENTRAL FOUNDRY COMPANY
An "IRON PRODUCTS CORPORATION" Industry
New Address: 41 East 42d St., New York
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trench with 48-inch steel
pipe, Detroit, Mich.
Contractors: Gillespie
Contracting Company

449

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Where to Purchase

A comprehensive Directory of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers, water-works superintendents, municipal and county engineering departments, street and highway officials, city managers, etc., and public officials who may desire to secure catalogs or prices on construction equipment. Where the name of a manufacturer is preceded by a star (*) it indicates that the user of the directory may secure further information by referring to the manufacturer's advertisement in this issue. The index to advertisers will be found on page facing the inside back cover.

ACETYLENE

Prest-O-Lite Co., Inc., New York.

ACETYLENE APPARATUS

Air Reduction Sales Co., New York.
Owens Acetylene Co., Newark, N. J.

ADDING MACHINES. (See Calculating Machines.)

AIR COMPRESSORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cement-Gum Co., Inc., Cornwall Hts., Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
De Laval Steam Turbine Co., Trenton, N. J.
De La Vergne Machine Co., N. Y. C.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
General Electric Co., Schenectady, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Indiana Air Pump Co., Indianapolis, Ind.
Ingersoll-Rand Co., N. Y. C.
Mundie Mfg. Co., Peru, Ill.
Nordberg Mfg. Co., Milwaukee, Wis.
Norwalk Iron Works Co., South Norwalk, Conn.
Schramm & Son, Inc., Chris. D., West Chester,
Pa.

Stratton & Bragg Co., Petersburg, Va.

Sullivan Mch. Co., Chicago, Ill.

United Iron Works, Kansas City, Mo.
Westinghouse Trac. Brake Co., Wilmerding, Pa.
Worthington Pump & Mch. Corp., N. Y. C.

ARC LAMPS

General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ARCHITECTURAL IRON WORK

Chesapeake Iron Works, Baltimore, Md.
Dietrich Bros., Baltimore, Md.
Hirsch Rolling Mill Co., St. Louis, Mo.
Snead Arch Iron Works, Louisville, Ky.

ARTESIAN WELL DRILLS AND PUMPS

Am. Well Works, Aurora, Ill.

ASBESTOS PRODUCTS

*Carey Co., Philip, Cincinnati, Ohio.
Dominion Asbestos & Rubber Corp., N. Y. C.
Keasbey & Mattison Co., Ambler, Pa.
Mikesel Bros. Co., Chicago, Ill.
Norristown Magnesia & Asbestos Co., Norristown, Pa.

Sall Mountain Co., Chicago, Ill.

ASH HANDLING MACHINERY

*Bay City Dredge Wks., Bay City, Mich.
*Hains Mfg. Co., Geo., New York.
*Weller Mfg. Co., Chicago, Ill.
Bartlett & Snow Co., C. O., Cleveland O.
Brown Hoisting Mach. Co., Cleveland, Ohio.
Byers Mach. Co., Ravenna, Ohio.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Green Eng. Co., East Chicago, Ind.
Guarantees Constr. Co., N. Y. C.
International Motor Co., New York.
Jeffrey Mfg. Co., Columbus, Ohio.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Eng. Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.
Portable Mch. Co., Passaic, N. J.
Robins Conv. Belt Co., N. Y. C.
Wheeler Mfg. Co., Chicago, Ill.

ASPHALT

*Barber Asphalt Co., Philadelphia, Pa.
*Pioneer Asphalt Co., Lawrenceville, Ill.

*Standard Oil Co. (Indiana), Chicago, Ill.

*Texas Co., N. Y. C.

Atlantic Refining & Asphalt Corp., Phila., Pa.

Barrett Co., New York.

Gulf Refining Co., Pittsburgh, Pa.

Headley Good Roads Co., Philadelphia, Pa.

Ky. Rock Asphalt Co., Louisville, Ky.

New Orleans Refining Co., New Orleans, La.

Sinclair Ref. Co., Chicago, Ill.

Standard Oil Co. of Calif., San Francisco, Cal.

Standard Oil Co. of La., New Orleans, La.

Standard Oil Co. of N. J., Newark, N. J.

Standard Oil Co. of N. Y., New York.

U. S. Asphalt Refining Co., New York.

Warren Bros. Co., Boston, Mass.

ASPHALT BLOCK

Hastings Pavement Co., New York.

ASPHALT CUTTERS

Dayton Pneumatic Tool Co., Dayton, Ohio.

Chicago Pneumatic Tool Co., Chicago, Ill.

Ingersoll-Rand Co., New York.

ASPHALT KETTLES. (See Kettles for Asphalt and Tar Heating.)

ASPHALT PLANTS, TOOLS, ETC.

*Barber Asphalt Co., Philadelphia, Pa.

*Connelly & Co., Philadelphia, Pa.

Austin Machinery Corp'n, Chicago, Ill.

Bacon Co., Edw. R., San Francisco, Cal.

Conklin & Harrington, Inc., N. Y., New York, N. Y.

Cummer & Conklin Co., F. D., Cleveland, O.

East Iron & Machine Co., Lima, Ohio.

Hetherington & Berner, Indianapolis, Ind.

Warren Bros. Co., Boston, Mass.

ASPHALT ROLLERS. (See Road and Paving Rollers.)

ASPHALT SURFACE HEATERS

*Barber Asphalt Co., Philadelphia, Pa.

*Equitable Asphalt Maint. Co., Kansas City, Mo.

Hanck Mfg. Co., Brooklyn, N. Y.

BACKFILLERS

*Koehring Co., Milwaukee, Wis.

*Pawling & Harnischfeger Co., Milwaukee, Wis.

*Weller Mfg. Co., Chicago, Ill.

American Cement Mch. Co., Inc., Keokuk, Ia.

Austin Machinery Corp'n, Chicago, Ill.

Byers Machine Co., Ravenna, Ohio.

Constr. Mch. Co., Waterloo, Ia.

Oshkosh Mfg. Co., Oshkosh, Wis.

Parsons Co., Newton, Ia.

BAR BENDERS AND CUTTERS

*Koehring Co., Milwaukee, Wis.

Concrete Steel Co., New York.

Concrete Welding Co., Pittsburgh, Pa.

Hinman & Co., D. A., Sandwich, Ill.

Mckenna Co., Cleveland, Ohio.

Ransome Concrete Machinery Co., Dunellen, N. J.

BAR CHAIRS, REINFORCING

*Truscon Steel Co., Youngstown, Ohio.

Concrete Steel Co., N. Y. C.

Universal Form Clamp Co., Chicago, Ill.

BARS, IRON AND STEEL

Ahorn Steel Co., Inc., N. Y. C.

Ames & Co., W., Jersey City, N. J.

Bethlehem Steel Co., Bethlehem, Pa.

Carbon Steel Co., Pittsburgh, Pa.

Carnegie Steel Co., Pittsburgh, Pa.

Franklin Steel Works, Franklin, Pa.

Gulf States Steel Co., Birmingham, Ala.

Hirsch Rolling Mill Co., St. Louis, Mo.

* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

Mile-A-Week Road Builder



Speed—Quality—Service

THIS machine tamped and finished 902 lineal feet of concrete road, 16 ft. wide, 8 inches deep in one day. The concrete was thoroughly worked from the bottom to the surface. Its various constituents were pressed together and densified by the action of the machine. This is typical of the work which our road builder does.

All tools, spaders and tamper have a positive and predetermined stroke, the length of which can be adjusted to meet requirements. There is practically no vibration and the motion of the machine does not injure or displace the forms.

The development of the Dunn machine has been gradual. Back of it are six years of thorough tests on actual road work. During these years practical men have brought out its merits. That its mechanical principles were fundamentally sound is shown from the fact that the first machines put out are still in service and doing good work.

Dunn quality and service are built into every one of these machines. Back of them is Dunn management, the same which has made Wire-Cut Lug Brick foremost in the paving brick industry throughout the country for nearly a score of years.

If you are interested in concrete road construction, you ought to know more about this machine. Circulars and prices forwarded immediately upon receipt of request.

The Dunn Road Machinery Co.
Conneaut, Ohio

Where to Purchase

5

- ILLINOIS STEEL**, Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
Midvale Steel & Ordnance Co., Philadelphia, Pa.
Republic Iron & Steel Co., Youngstown, O.
St. Louis Screw Co., St. Louis, Mo.
Sweet's Steel Co., Williamsport, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
United Alloy Steel Corp., Canton, Ohio.
BELTING, RUBBER
Allen Mfg. Co., W. D., Chicago, Ill.
Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
Fairbanks Co., The, N. Y. C.
Goodall Rubber Co., Inc., Philadelphia, Pa.
Goodyear Tire & Rubber Co., Akron, O.
McMaster-Carr Supply Co., Chicago, Ill.
Mulconroy Co., Inc., Philadelphia, Pa.
Republic Rubber Co., Youngstown, Ohio.
Robins Conv. Belt Co., New York.
Salisbury & Co., Inc., W. H., Chicago, Ill.
Southern Rubber & Belt Co., Houston, Tex.
Union Asbestos & Rubber Co., Chicago, Ill.
Voorhees Rubber Mfg. Co., Jersey City, N. J.
BINS, STORAGE
***Good Roads Mach'y Co.**, Kennett Square, Pa.
***Weller Mfg. Co.**, Chicago, Ill.
Atlas Eng. Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Galion Iron Works & Mfg. Co., Galion, Ohio.
Green Engineering Co., E. Chicago, Ind.
Link-Belt Co., Chicago, Ill.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Ransom Concrete Machy. Co., Dunellen, N. J.
BLAST HOLE DRILLING MACHINES. (See "Well Drilling and Blast Hole Machines")
BLASTING POWDER (See Explosives)
BLOCKS AND TACKLE
Boston & Lockport Block Co., East Boston, Mass.
Broderick & Bascom Rope Co., St. Louis, Mo.
Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
Topping Bros., N. Y. C.
Upson-Walton Co., Cleveland, Ohio.
BLOWERS, PRESSURE
American Blower Co., Detroit, Mich.
American Gas Furnace Co., N. Y. C.
De Laval Steam Turbine Co., Trenton, N. J.
General Electric Co., Schenectady, N. Y.
Spencer Turbine Co., Hartford, Conn.
Surtevant Co., B. F., Hyde Park, Boston, Mass.
BLOWPIPES
Oxweld Acetylene Co., Newark, N. J.
BLUE PRINT MACHINES
Dietzgen Co., Eugene, Chicago, Ill.
Kenfert & Esser Co., Hoboken, N. J.
Pease Co., C. F., Chicago, Ill.
Weber & Co., Philadelphia, Pa.
Wickes Bros., Saginaw, Mich.
BLUE PRINT AND TRACING PAPERS
Indianapolis Blue Print & S'ply Co., Ind'apolis.
Koelsch & Co., New York.
BOILERS
Abendroth & Root Mfg. Co., Newburgh, N. Y.
Ames Iron Works, Oswego, N. Y.
Babcock & Wilcox Co., N. Y. C.
Biggs Boiler Wks., Akron, Ohio.
Casey-Hedges Co., Chattanooga, Tenn.
Chandler & Taylor Co., Indianapolis, Ind.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Cole Mfg. Co., R. D., Newnan, Ga.
Erie City Iron Works, Erie, Pa.
Flory Mfg. Co., S., Bangor, Pa.
Hartley Boiler Works, Montgomery, Ala.
Heine Boiler Co., St. Louis, Mo.
Houston, Stanwood & Gamble Co., Cincinnati, O.
Ladd Co., Geo. T., Pittsburgh, Pa.
Leffel & Co., J., Springfield, O.
Lord & Burnham Co., Irvington, N. Y.
Murray Iron Works Co., Burlington, Ia.
New Bern Iron Wks. & Sup. Co., New Bern, N. C.
Petroleum Iron Works Co., Sharon, Pa.
Randie Mch'y. Co., Cincinnati, O.
Schofield Iron Works, Macon, Ga.
Traylor Engr. & Mfg. Co., Allentown, Pa.
Vail & Murdoch Co., Charleston, S. C.
Vogt Mch'y. Co., Inc., Louisville, Ky.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.
BOLTS, NUTS, NAILS, RIVETS, SPIKES
Ames & Co., W., Jersey City, N. J.
American Screw Co., Providence, R. I.
American Spike Co., N. Y. C.
Ames, W. & Co., Jersey City, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
BUCKETS, AUTOMATIC DUMPING
***Littleford Bros.**, Cincinnati, O.
***Weller Mfg. Co.**, Chicago, Ill.
Lakewood Engineering Co., Cleveland, O.
Stuebner Iron Works, G. L., Long Island City, N. Y.
BUCKETS, CLAM SHELL
***Haiss Mfg. Co.**, Geo., New York.
***Industrial Works**, Bay City, Mich.

* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

- BUCKLES, TRENCH**
***Waldo Bros. & Bond Co.**, Boston, Mass.
Channon Mfg. Co., Jas. H., Chicago, Ill.
Duff Mfg. Co., Pittsburgh, Pa.
Kalamazoo Dry & Mach. Co., Kalamazoo, Mich.
BRASS GOODS
***Union Water Meter Co.**, Worcester, Mass.
Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.
Hays Mfg. Co., Erie, Pa.
Mueller Mfg. Co., H., Decatur, Ill.
United Brass Mfg. Co., Cleveland, O.
BRICK, PAVING (See Paving Brick)
BRIDGES AND BUILDINGS, STEEL
***Snare Corp.**, Frederick, New York, N. Y.
American Bridge Co., N. Y. C.
Bellefontaine Bridge & Steel Co., Bellefontaine, O.
Belmont Iron Works, Philadelphia, Pa.
Berlin Constr. Co., Berlin, Conn.
Bethlehem Steel Bridge Corp., Bethlehem, Pa.
Blew-Knox Co., Pittsburgh, Pa.
Boston Bridge Works, Boston, Mass.
Central States Bridge Co., Indianapolis, Ind.
Champion Bridge Co., Wilmington, O.
Chesapeake Iron Works, Baltimore, Md.
Chicago Bridge & Iron Works, Chicago, Ill.
Clinton Bridge Wks., Clinton, Iowa.
Eastern Bridge & Struc. Co., Worcester, Mass.
Ferguson Co., H. K., Cleveland, O.
Flour City Orn. Iron Co., Minneapolis, Minn.
Fort Pitt Bridge Works, Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.
Ingalls Iron Works Co., Birmingham, Ala.
Inland Steel Co., Chicago, Ill.
Inter. Steel & Iron Co., Evansville, Ind.
King Bridge Co., Cleveland, O.
Lackawanna Bridge Wks. Corp., Buffalo, N. Y.
Lewis-Hall Iron Wks., Detroit, Mich.
Louisville Bridge & Iron Co., Louisville, Ky.
McClintic Marshall Co., Pittsburgh, Pa.
Milwaukee Bridge Co., Milwaukee, Wis.
Minn. Steel & Mch'y. Co., Minneapolis, Minn.
Missouri Vt. Bdge. & Iron Co., Leavenworth, Kan.
Morava Constr. Co., Chicago, Ill.
Mt. Vernon Bridge Co., Mt. Vernon, Ohio.
Penn. Bridge Co., Beaver Falls, Pa.
Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
Richmond Struc. Steel Co., Richmond, Va.
Riverside Bridge Co., Martins Ferry, O.
Toledo Crane Co., Toledo, O.
Virginia Bridge & Iron Co., Roanoke, Va.
Wide. Bridge & Iron Co., North Milwaukee, Wis.
BRONZE TABLETS
Flour City Orn. Iron Co., Minneapolis, Minn.
Imperial Brass Mfg. Co., Chicago, Ill.
BROOMS, HAND FOR STREET CLEANING, ETC.
Holcomb Mfg. Co., J. L., Indianapolis, Ind.
Ind. Brush & Broom Mfg. Co., Indianapolis, Ind.
Kendallville Broom & Brush Co., Kendallville, Ind.
Lay Co., Jos., Ridgeville, Ind.
Milwaukee Brush Mfg. Co., Milwaukee, Wis.
Osborn Mfg. Co., Cleveland, Ohio.
BUCKETS, AUTOMATIC DUMPING
***Littleford Bros.**, Cincinnati, O.
***Weller Mfg. Co.**, Chicago, Ill.
Lakewood Engineering Co., Cleveland, O.
Stuebner Iron Works, G. L., Long Island City, N. Y.
BUCKETS, CLAM SHELL
***Haiss Mfg. Co.**, Geo., New York.
***Industrial Works**, Bay City, Mich.



Works Faster on More Jobs

CLETRAC has the strength of six animals and operates in the space required for one. It backs up or starts ahead quickly and keeps the dirt moving from the excavation in a steady stream.

Two ground-gripping tracks that quickly climb in and out of holes—that walk easily over mud and cinders, sand and snow—enable Cletrac to keep going from morning till night in heat, rain or snow. This accounts for Cletrac's ability to speed up the work and cut costs on a wide variety of jobs.

We have facts and figures showing Cletrac's money saving ability on all kinds of jobs. Let us tell you how Cletrac too increased profits right in your vicinity. Write us today.

THE CLEVELAND TRACTOR CO.
Largest Producers of Tank-Type Tractors in the World

19211 Euclid Avenue

Cleveland, Ohio



These Are All Cletrac Jobs

- Pulling Ditching Machines
- Pulling Rooter and Grading Plows
- Handling Fresno or Wheel Scrapers
- Hauling away Dirt
- Bringing in Material
- Operating Stone Crusher, Gravel Screening Mill, Concrete Mixers, Conveyors and Elevators
- Pulling Graders and Levelers
- Pulling Heavy Rollers
- Pulling or Pushing Snow Plows
- Cleaning Roadside Drains
- Working in and out of Excavations
- Mowing Roadsides
- Hauling Dump Cars on Industrial Railroad
- Building Golf Courses and Parks
- Mowing and General Maintenance of Golf Courses and Parks



HARD THE WAY, BUT—



EASY ON A TRACK THE CLETRAC WAY

Where to Purchase

7

Advance Eng. Co., Cleveland, O.
 Austin Mach. Corp., Chicago, Ill.
 Blaw-Knox Co., Pittsburgh, Pa.
 Brosius, E. E., Pittsburgh, Pa.
 Brown Hoisting Machy. Co., Cleveland, O.
 Browning Co., Cleveland, O.
 Byers Mach. Co., J. F., Ravenna, O.
 Hayward Co., N. Y. C.
 Kiesler Co., J. F., Chicago, Ill.
 Lakewood Engineering Co., Cleveland, O.
 Link-Belt Co., Chicago, Ill.
 Orton & Steinbrenner Co., Chicago, Ill.
 Owen Bucket Co., Cleveland, Ohio.
 Williams Co., G. H., Erie, Pa.

BUCKETS, CONCRETE

*Koppel Ind. Car & Equip. Co., Koppel, Pa.
 *Rausome Concrete Machy. Co., Dunellen, N. J.
 *Rochester Can Co., Rochester, N. Y.
 *Smith Co., T. L., Milwaukee, Wis.
 *Wells Mfg. Co., Chicago, Ill.
 Inslay Mfg. Co., Indianapolis, Ind.
 Lakewood Engineering Co., Cleveland, O.
 Union Iron Works, Inc., Hoboken, N. J.

BUCKETS, DRAGLINE

*Industrial Works, Bay City, Mich.
 *Sauerman Bros., Chicago, Ill.
 Austin Machinery Corp'n, Chicago, Ill.
 Brown Hoisting Mach. Co., Cleveland, O.
 Bucyrus Co., So. Milwaukee, Wis.
 Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
 Hayward Co., N. Y. C.
 Link-Belt Co., Chicago, Ill.
 Monighan Machine Co., Chicago, Ill.

BUCKETS, DREDGING AND EXCAVATING

Austin Machinery Corp'n, Chicago, Ill.
 Blaw-Knox Co., Pittsburgh, Pa.
 Brown Hoisting Mach. Co., Cleveland, O.
 Browning Co., Cleveland, O.
 Hayward Co., N. Y. C.
 Inslay Mfg. Co., Indianapolis, Ind.
 Kiesler Co., J. F., Chicago, Ill.
 Lakewood Eng. Co., Cleveland, O.
 Mead-Morrison Mfg. Co., East Boston, Mass.
 Monighan Machine Co., Chicago, Ill.
 Owen Bucket Co., Cleveland, Ohio.
 Union Iron Works, Inc., Hoboken, N. J.
 Williams Co., G. H., Erie, Pa.

BUCKETS, ORANGE PEEL

*Hans Mfg. Co., Geo., N. Y. C.
 *Industrial Works, Bay City, Mich.
 Hayward Co., New York.
 Kiesler Co., J. F., Chicago, Ill.
 McMyler Interstate Co., Cleveland, O.
 Mead-Morrison Mfg. Co., East Boston, Mass.
 Orton & Steinbrenner Co., Chicago, Ill.
 Vulcan Iron Works, Jersey City, N. J.

BUILDERS' HARDWARE

Corbin P. & F., New Britain, Conn.
 Reading Hardware Co., Reading, Pa.
 Russell & Erwin Mfg. Co., New Britain, Conn.
 Sargent & Co., New Haven, Conn.
 Stanley Works, New Britain, Conn.
 Yale & Towne Mfg. Co., New York.

BUILDINGS, STEEL (See Bridges and Buildings)

BUNKS AND COTS

Fort Pitt Bedding Co., Pittsburgh, Pa.
 Haggard & Marcuson Co., Chicago, Ill.
 Southern Rome Co., Baltimore, Md.

CABLES (See Wire and Cables)

CARLEWAYS

*Flory Mfg. Co., S., Bangor, Pa.
 *Sauerman Bros., Chicago, Ill.
 Broderick & Bascom Hope Co., St. Louis, Mo.
 Lidgewood Manufacturing Co., New York.
 Roehling Sons Co., J. A., Trenton, N. J.
 Waterbury Co., N. Y. C.

CAISSENS

American Bridge Co., N. Y. C.
 Foundation Co., N. Y. C.
 Lackawanna Steel Co., Buffalo, N. Y.
 O'Rourke Eng. Constr. Co., N. Y. C.
 Petroleum Iron Works Co., Sharon, Pa.

CALCULATING MACHINES

*Monroe Calculating Machine Co., Orange, N. J.
 Burroughs Adding Machine Co., Detroit, Mich.
 Felt & Tarrant Mfg. Co., Chicago, Ill.
 Marchant Calc. Machine Co., Oakland, Cal.

*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

CANS FOR GARBAGE AND STREET REFUSE

*Littleford Bros., Cincinnati, O.
 *Rochester Can Co., Rochester, N. Y.
 American Can Co., New York.
 Butler Mfg. Co., Minneapolis, Minn.
 Safety Sanitary Rubbish Box Co., Columbus, O.
 Steel Basket Co., Cedar Rapids, Iowa.

CARS, INDUSTRIAL V. DUMPING

*Easton Car & Const'n Co., New York
 *Koppel Ind. Car & Eq. Co., Koppel, Pa.
 *Weier Mfg. Co., Chicago, Ill.
 Atias Car & Mfg. Co., Cleveland, O.
 Austin Machinery Corp'n, Chicago, Ill.
 Chase Fdry. & Mfg. Co., Columbus, O.
 Easton Car & Const'n Co., New York.
 Inslay Mfg. Co., Indianapolis, Ind.
 Kilbourne & Jacobs Mfg. Co., Columbus, O.
 Lakewood Engineering Co., Cleveland, O.
 Oliver Mfg. Co., W. J., Knoxville, Tenn.
 Light Ry. Equipment Co., Philadelphia, Pa.
 Stuebner Iron Works, G. L., Long Island City,
 N. Y.
 United Iron Works, Kansas City, Mo.
 Whiting Corp'n, Harvey, Ill.

CARTS, CONCRETE

*Littleford Bros., Cincinnati, O.
 *Smith Co., T. L., Milwaukee, Wis.
 Akron Barrow Co., Cleveland, Ohio.
 Etnyre & Co., E. D., Oregon, Ill.
 Gray Iron Fdry. Co., Reading, Pa.
 Inslay Mfg. Co., Indianapolis, Ind.
 Kilbourne & Jacobs Mfg. Co., Columbus, O.
 Lakewood Engineering Co., Cleveland, O.
 Lee Trailer & Body Co., Chicago, Ill.
 Ransom Concrete Machy. Co., Dunellen, N. J.
 Standard Scale & Supply Co., Pittsburgh, Pa.
 Sterling Wheelbarrow Co., Milwaukee, Wis.
 Toledo Wheelbarrow Co., Toledo, Ohio.

CAST IRON PIPE (See Pipe, Cast Iron)

CASTINGS, STREET AND SEWER

*Central Foundry Co., New York.
 *Clark Co., H. W., Mattoon, Ill.
 *U. S. Cast Iron Pipe & Fdry. Co., Burlington,
 N. J.
 Canton Foundry & Machine Co., Canton, O.
 Casey-Hedges Co., Chattanooga, Tenn.
 Clow & Sons, J. B., Chicago, Ill.
 Dee Co., W. E., Chicago, Ill.
 Dobbie Foundry & Mach. Co., Niagara Falls,
 N. Y.
 Foundry Mfg. Co., St. Albans, Vt.
 Klaner Mfg. Co., Dubuque, Iowa.
 Madison Foundry Co., Cleveland, O.
 Pechstein Iron Works, Keokuk, Ia.
 Reading Steel Casting Co., Bridgeport, Conn.
 Sessions Foundry Co., Bristol, Conn.
 South Bend Foundry Co., South Bend, Ind.

CATCH BASIN CLEANING APPARATUS

Elgin Sales Corp., New York.
 International Motor Co., New York.

CAULKING MACHINERY AND TOOLS

Heilig Mfg. Co., St. Paul, Minn.
 Ingerman-Rand Co., N. Y. C.
 Mueller Mfg. Co., H., Decatur, Ill.

CEILINGS, METAL

Berger Mfg. Co., Canton, O.
 Canton Art Metal Co., Canton, O.
 Newport Rolling Mill Co., Newport, Ky.
 Klaner Mfg. Co., Dubuque, Iowa.
 Mesker & Co., Geo. L., Evansville, Ind.
 Milwaukee Corrugating Co., Milwaukee, Wis.
 Wheeling Corrugating Co., Wheeling, W. Va.

CEMENT

*Pennsylvania Cement Co., New York.
 *Eta Portland Cement Co., Detroit, Mich.
 Allentown Portland Cement Co., Allentown, Pa.
 Alpha Portland Cement Co., Easton, Pa.
 Ash Grove Lime and Portland Cement Co.,
 Kansas City, Mo.
 Atlas Portland Cement Co., New York.
 Bath Portland Cement Co., Philadelphia, Pa.
 Beaver Portland Cement Co., Portland, Ore.



For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

PATENT COMBINATION Auto Heater and Distributor

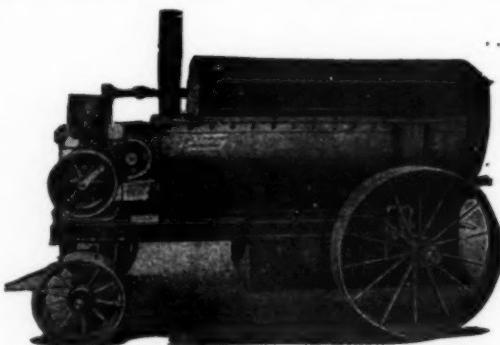


HANDY HEATER and SPRAYER

Especially adapted for Road maintenance, construction and general repair work. Contents constantly agitated while heating.

No burning or coking of material. Pump, Piping, Hose, Nozzles, Automatically Heated.

No Steam Required.



Kinney Manufacturing Company

3529 Washington Street
BOSTON, MASSACHUSETTS

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9

Bessemer Limestone and Cement Co., Youngstown, O.
 Bonner Portland Cement Co., Kansas City, Mo.
 Canada Cement Co., Ltd., Montreal, Canada.
 Cape Girardeau Portland Cement Co., Cape Girardeau, Mo.
 Castalia Portland Cement Co., Pittsburgh, Pa.
 Clinchfield Portland Cement Corp., Kingsport, Tenn.
 Colorado Portland Cement Co., Denver, Colo.
 Continental Portland Cement Co., St. Louis, Mo.
 Coplay Cement Manufacturing Co., Coplay, Pa.
 Cowell Portland Cement Co., San Francisco, Cal.
 Crescent Portland Cement Co., Wampum, Pa.
 Dewey Portland Cement Co., Kansas City, Mo.
 Dexter Portland Cement Co., Nazareth, Pa.
 Diamond Portland Cement Co., Cleveland, Ohio.
 Dixie Portland Cement Co., Chattanooga, Tenn.
 Edison Portland Cement Co., New York.
 Fredonia Portland Cement Co., Fredonia, Kans.
 Giant Portland Cement Co., Philadelphia, Pa.
 Gilmore Portland Cement Corp., Gilmore City, Iowa.
 Glens Falls Portland Cement Co., Glens Falls, N. Y.
 Golden State Portland Cement Co., Los Angeles, Cal.
 Gulf States Portland Cement Co., Demopolis, Ala.
 Hawkeye Portland Cement Co., Des Moines, Ia.
 Helderberg Cement Co., Albany, N. Y.
 Hercules Cement Corp., Philadelphia, Pa.
 Indiana Portland Cement Co., Indianapolis, Ind.
 International Portland Cement Co., Ltd., Spokane, Wash.
 Knickerbocker Portland Cement Co., Inc., New York.
 Kosmos Portland Cement Co., Louisville, Ky.
 Lawrence Port'l'd Cement Co., Northampton, Pa.
 Leigh Portland Cement Co., Allentown, Pa.
 Louisville Cement Co., Louisville, Ky.
 Marquette Cement Mfg. Co., Chicago, Ill.
 Missouri Portland Cement Co., St. Louis, Mo.
 Monarch Cement Co., Humboldt, Kans.
 Nazareth Cement Co., Nazareth, Pa.
 Newaygo Portland Cement Co., Newaygo, Mich.
 Nebraska Cement Co., Denver, Colo.
 New Egyptian Portland Cement Co., Fenton, New York & New England Cement & Lime Co., New York.
 Northwestern States Portland Cement Co., Mason City, Ia.
 Ogden Portland Cement Co., Ogden, Utah.
 Oklahoma Portland Cement Co., Denver, Colo.
 Old Mission Portland Cement Co., San Francisco, Cal.
 Olympic Port'l'd Cement Co., Ltd., Seattle, Wash.
 Oregon Portland Cement Co., Portland, Ore.
 Pacific Portland Cement Co., San Francisco, Cal.
 Peirce Portland Cement Co., Union City, Mich.
 Peninsular Portland Cement Co., Cement City, Mich.
 Penn-Allen Cement Co., Allentown, Pa.
 Petoskey Portland Cement Co., Petoskey, Mich.
 Phoenix Portland Cement Co., Nazareth, Pa.
 Portland Cement Co. of Utah, Salt Lake City, Utah.
 Pyramid Portland Cement Co., Des Moines, Ia.
 Riverside Port'l'd Cement Co., Los Angeles, Cal.
 San Antonio Portland Cement Co., San Antonio, Tex.
 Sandusky Cement Co., Cleveland, Ohio.
 Santa Cruz Portland Cement Co., San Francisco, Cal.
 Security Cement and Lime Co., Hagerstown, Md.
 Signal Mountain Portland Cement Co., Chattanooga, Tenn.
 Southern States Portland Cement Co., Rockport, Ga.
 Southwest'n Portland Cement Co., El Paso, Tex.
 Standard Portland Cement Corp., San Francisco, Calif.
 Superior Portland Cement Co., Seattle, Wash.
 Texas Portland Cement Co., Dallas, Tex.
 Three Forks Portland Cement Co., Denver, Colo.
 Tidewater Portland Cement Co., Baltimore, Md.
 Trinity Portland Cement Co., Dallas, Tex.
 Union Portland Cement Co., Ogden, Utah.
 United States Potash Co., Los Angeles, Cal.
 U. S. Portland Cement Co., Denver, Colo.
 Universal Portland Cement Co., Chicago, Ill.
 Vulcanite Portland Cement Co., Philadelphia, Pa.

Wabash Portland Cement Co., Detroit, Mich.
 Wellston Iron Furnace Co., Jackson, Ohio.
 Western States Portland Cement Co., Independence, Kans.
 Whitehall Cement Mfg. Co., Philadelphia, Pa.
 Wolverine Port'l'd Cement Co., Coldwater, Mich.
 Wyandotte Portland Cement Co., Detroit, Mich.

CEMENT INSPECTION (See Inspecting Laboratories)

CHAIN

*Weller Mfg. Co., Chicago, Ill.
 American Chain Co., Inc., Bridgeport, Conn.
 Chain Belt Co., Milwaukee, Wis.
 Columbus McKinnon Chain Co., Columbus, O.
 Jeffrey Mfg. Co., Columbus, O.
 Link-Belt Co., Chicago, Ill.
 Niagara Metal Stamp. Corp., Niagara Falls, N. Y.
 U. S. Chain & Forge Co., Pittsburgh, Pa.
 Webster Mfg. Co., Chicago, Ill.

CHECK VALVES

Columbian Iron Works, Chattanooga, Tenn.
 Ludlow Valve Mfg. Co., Troy, N. Y.
 Lunkhenheimer Co., Cincinnati, O.
 Mueller Mfg. Co., H., Decatur, Ill.

CHEMICALS FOR WATER PURIFICATION

Du Pont de Nemours & Co., E. I., Wilmington, Del.
 Electro Bleaching Gas Co., New York.
 General Chemical Co., New York.
 Mathieson Alkali Works, Inc., N. Y. C.
 Penna. Salt Mfg. Co., Philadelphia, Pa.

CHIMNEYS, CONCRETE

Heine Chimney Co., Chicago, Ill.
 Rust Engineering Co., Pittsburgh, Pa.
 Weber Chimney Co., Chicago, Ill.

CHIMNEYS, RADIAL BRICK

*American Chimney Corp., New York City.
 Custodis Chimney Const. Co., Alphons, New York.
 Kellogg & Co., M. W., New York.
 Rust Engineering Co., Pittsburgh, Pa.

CHIMNEYS, STEEL (See Stacks, Steel)

CHLORINATORS

*Wallace & Tiernan Co., Inc., Newark, N. J.

CHLORINE, LIQUID (See Liquid Chlorine)

CHUTES, CONCRETE

Akron Barrow Co., Cleveland, Ohio
 Inslay Mfg. Co., Indianapolis, Ind.
 Lakewood Engineering Co., Cleveland, O.
 Ransom Concrete Machy. Co., Dunellen, N. J.

CLIPS, WIRE ROPE

American Hoist & Derrick Co., St. Paul, Minn.
 American Steel & Wire Co., Chicago, Ill.
 Broderick & Bascom Rope Co., St. Louis, Mo.
 Carpenter Co., Geo. B., Chicago, Ill.
 Leschen & Sons Rope Co., A., St. Louis, Mo.
 Marion Malleable Iron Works, Marion, Ind.
 Mockbee & Co., C. M., Cincinnati, O.
 Roehling Sons Co., J. A., Trenton, N. J.
 Upon-Walton Co., Cleveland, O.

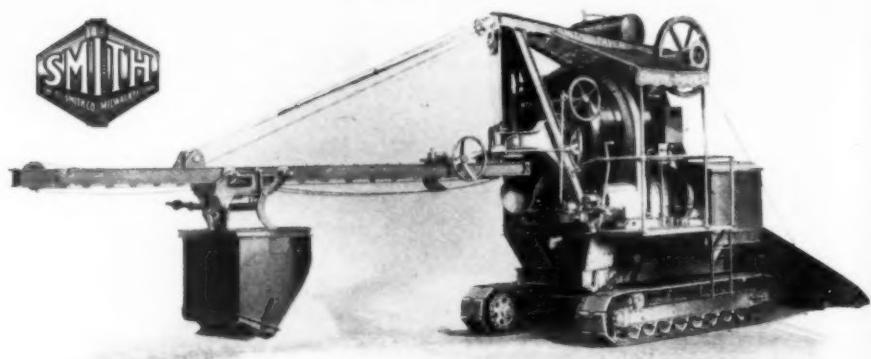
COAL AND ORE CONVEYING MACHINERY

*Good Roads Mach'y Co., Kennett Square, Pa.
 Haiss Mfg. Co., Geo., New York.
 *Weller Mfg. Co., Chicago, Ill.
 Barber-Green Co., Aurora, Ill.
 Bartlett & Snow Co., C. O., Cleveland, Ohio.
 Blaw-Knox Co., Pittsburgh, Pa.
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 Byers Machine Co., Ravenna, Ohio.
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 Corrugated Bar Co., Inc., Buffalo, N. Y.
 Fairfield Engineering Co., Lancaster, Ohio.
 Gifford-Wood Co., Hudson, N. Y.
 Hayward Co., New York.
 Hunt Co., Inc., C. W., West New Brighton, N. Y.
 Jeffrey Mfg. Co., Columbus, O.
 Lidgerwood Mfg. Co., New York.
 Link-Belt Co., Chicago, Ill.
 Mead-Morrison Mfg. Co., E. Boston, Mass.
 Portable Machinery Co., Passaic, N. J.
 Robins Conveying Belt Co., New York.
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COCKS, CURB AND CORPORATION

*Union Water Meter Co., Worcester, Mass.

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Better Pavers

Smith Mixers were introduced to the contractor nearly a quarter of a century ago, when the use of concrete had just begun.

The 1922 Smith Paver is the finished product of years of experience, the last word in paver design.

SMITH FEATURES:

- Strongest Frame**
(Completely riveted—lowest height)
- All-Steel Drum**
Largest openings — fewest blades)
- Power Discharge**
(Simplest of all—gears run in oil)
- Cross Dump Bucket**
(Largest capacity—Spreadertype—double doors, fully adjustable)
- Simplest Construction**
(Fewest number of gears, bearings and parts)
- Actual One-Man Control**
(Least number of operating levers)
- Caterpillar Traction**
(All steel parts — three-point suspension)
- Largest and Widest Skip**
(Takes load from trucks, or two wheelbarrows at a time).

Smith Pavers are the soundest investment value—they will see you through your road jobs.

They are good mixers, popular, and have a large following in all parts of the country. Put *Smith* on your force,—you'll profit by his all-round ability and steadiness.

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New 1922 Paver Catalog

SMITH PAVERS

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Haydenville Co., Haydenville, Mass.
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Granitex Corp., New York.
Horn Co., A. C., Long Island City, N. Y.
Master Builders Co., Cleveland, O.
Sonnenborn Sons, Inc., L. N. Y. "Lapidolith"

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*Koehring Co., Milwaukee, Wis.
*Knickerbocker Co., Jackson, Mich.
*Smith Co., T. L., Milwaukee, Wis.
American Cement Machine Co., Keokuk, Ia.
Atlas Engineering Co., Milwaukee, Wis.
Austin Machinery Corp., Chicago, Ill.
Badger Concrete Mixer Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Iowa.
Contractors' Equipment Co., Keokuk, Ia.
Footh Concrete Mach'y Co., Chicago, Ill.
Gray Iron Fdry Co., Reading, Pa.
Jaeger Machine Co., Columbus, O.
Judy Mfg. Co., Centerville, Ia.
Lakewood Engineering Co., Cleveland, O.
Lansing Co., Lansing, Mich.
Marsh-Capron Co., Chicago, Ill.
Oshkosh Mfg. Co., Oshkosh, Wis.
Hansome Concrete Mach'y Co., Dunellen, N. J.
Republic Iron Works, Tecumseh, Mich.
Schramm & Son, Inc., Chris. D., West Chester,
Pa.

Standard Scale & Supply Co., Pittsburgh, Pa.
Truckmixer Co., Milwaukee, Wis.
Worthington Pump & Mach'y Corp., New York.

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American Steel & Wire Co., Chicago, Ill.
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Concrete Steel Co., New York.
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Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
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Ryerson & Son, J. T., Chicago, Ill.
Wickwire Spencer Steel Corp., Worcester, Mass.

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Lakewood Eng. Co., Cleveland, Ohio.

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Turbin Sewer Machine Co., Milwaukee, Wis.
Walde Bros. & Bond Co., Boston, Mass.

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American Circular Loom Co., Boston, Mass.
Central Tube Co., Pittsburgh, Pa.
National Metal Molding Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

CONDUTS, UNDERGROUND

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Dickey Clay Mfg. Co., W. S., Kansas City, Mo.

Fibre Conduit Co., Orangeburg, N. Y.

Johns-Manville, Inc., New York.

National Fireproofing Co., New York.

CONTRACTORS SUPPLY DEALERS

See pages 76-87.

CONTRACTORS' USED EQUIPMENT

*King, Philip T., New York.

*Grey Steel Prod. Co., New York.

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*Haettner Co., R. E., New York.

*Peerless Iron & Metal Co., Detroit, Mich.
Briggs, Inc., Marvin, Brooklyn, New York.
Contractors' Mach. & Supply Co., Pittsburgh, Pa.
Reading Engineering Co., New York.
Zelnicker Supply Co., Walter A., St. Louis, Mo.

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*Good Roads Mach'y Co., Kennett Square, Pa.
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Barber-Greene Co., Aurora, Ill.
Chain Belt Co., Milwaukee, Wis.
Gifford Wood Co., Hudson, N. Y.
Goodyear Tire & Rubber Co., Akron, O.
Imperial Belting Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Olson & Co., Sam'l, Chicago, Ill.
Portable Mach'y Co., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
Robins Conv. Belt Co., N. Y. C.
Standard Conveyor Co., No. St. Paul, Minn.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

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*Weller Mfg. Co., Chicago, Ill.
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Bartlett & Snow Co., C. O., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford Wood Co., Hudson, N. Y.
Godfrey Conveyor Co., Elkhart, Ind.
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Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Olson & Co., Sam'l, Chicago, Ill.
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Robins Conv. Belt Co., N. Y. C.
Webster Mfg. Co., Chicago, Ill.

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Standard Conveyor Co., No. St. Paul, Minn.
Mathews Gravity Carrier Co., Ellwood City, Pa.

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*Pawling & Harnischfeger Co., Milwaukee, Wis.
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Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Davenport Locomotive Works, Davenport, Ia.
Eric Steam Shovel Co., Erie, Pa.
Hanna Eng. Works, Chicago, Ill.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Champaign, Ill.
Marion Steam Shovel Co., Marion, O.
McMyler Interstate Co., Cleveland, O.
Northwest Engineering Works, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.
Overland Crane Co., Hammond, Ind.
Shaw Crane Wks., Muskegon, Mich.
U. S. Crane Co., Chicago, Ill.

CRANES, TRAVELING

*Bay City Dredge Works, Bay City, Mich.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Terry Mfg. Co., New York.
Brown Hoisting Mach'y Co., Cleveland, O.
Byers Machine Co., Ravenna, Ohio.
Chesapeake Iron Works, Baltimore, Md.
Hanna Eng. Works, Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Northern Eng. Works, Detroit, Mich.
Shaw Crane Works, Muskegon, Mich.
Speidel, J. G., Reading, Pa.
Toledo Crane Co., Toledo, Ohio.
U. S. Crane Co., Chicago, Ill.
Universal Crane Co., Cleveland, O.
Whiting Corp'n, Harvey, Ill.

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Bucyrus Co., South Milwaukee, Wis.
Industrial Works, Bay City, Mich.
Shaw Crane Works, Muskegon, Mich.

The Jack for All Trades

*Never Turns Around
Never Backs Down*



The Doughboy Jack

—the lightest jack made for its capacity. Weighs considerably less than other jacks of equal power, in some sizes less than half as much.

Sizes for 15 to 100 tons

Easy to operate; a 24-inch handle provides ample leverage. Has a positive check to prevent damage from over-extension. Made of steel throughout.

*Bulletin 29 tells all about
the Doughboy Jack.*

McKiernan-Terry Drill Company

Rock Drills—Pile Hammers—Lifting Jacks—Mining and Quarrying Machinery

, 19 PARK ROW, NEW YORK

Works at Dover, N. J.

Agencies in the following Cities: Boston, Chicago, Pittsburgh, Cleveland, Detroit, St. Paul, San Francisco, Columbus, O., New Orleans, Philadelphia, Portland, Oregon.

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A convertible loader, digger, or derrick operates following attachments:

¾-yd. clamshell
Dragline
Dipper

Hook
Skimmer Scoop
Ditcher Scoop

Electric Magnet

Gasoline engine or electric motor, crawler trucks or tractor wheels. All steel boom, standard length, 30 feet. One-man operation. Easy control.

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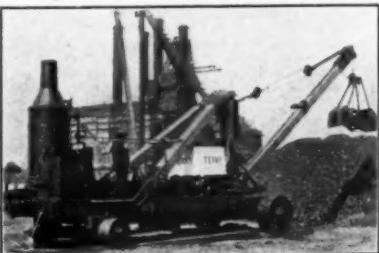
THE ONE MAN EXCAVATOR

A light, low priced, economical digger for clay, sand and gravel pits, Road Contractors, small trenches, or light excavation of any sort. $\frac{3}{4}$ cubic yard dumper or $\frac{3}{2}$ yard Clamshell. Self propelling. Track or caterpillar type mounting.

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2622 Centre Ave. Bay City, Mich.

TERRY

For a Quarter of a Century Building all Types of



CRANES



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Creosoted Materials Co., New Orleans, La.
Jennison-Wright Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Southern Paving Constr. Co., Chattanooga, Tenn.
Southern Wood Pres. Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

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Am. Creosote Wks., Inc., New Orleans, La.
Barrett Co., New York.
Jennison-Wright Co., Toledo, O.
Southern Creosoting Co., Ltd., Shreveport, La.
Southern Paving Const. Co., Chattanooga, Tenn.
Wyckoff Pipe & Creosoting Co., New York.

CRUSHERS AND PULVERIZERS (See Rock Crushers)

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*Good Roads Machinery Co., Kennett Square, Pa.
*Newport Culvert Co., Newport, Ky.
*Kussell Grader Mfg. Co., Minneapolis, Minn.
*U. S. C. I. Pipe & Fdry. Co., Burlington, N. J.
American Cast Iron Pipe Co., Birmingham, Ala.
Canton Culvert & Silo Co., Canton, O.
Clow & Sons, J. B., Chicago, Ill.
Concrete Form Co., Inc., Syracuse, N. Y.
Doe Co., W. E., Chicago, Ill.
Dominion Metal Products Corp., Roanoke, Va.
Florida Metal Products Co., Jacksonville, Fla.
Galton Iron Works & Mfg. Co., Marion, O.
Hardiey Mfg. Co., The H., Denver, Colo.
Klauber Mfg. Co., Dubuque, Ia.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Madison Foundry Co., Cleveland, O.
Southern Metal Culvert Co., Salisbury, N. G.
Wheeling Corrugating Co., Wheeling, W. Va.
Wood & Co., R. D., Philadelphia, Pa.

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Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, J. B., Chicago, Ill.
Foundry Mfg. Co., St. Albans, Vt.
Madison Foundry Co., Cleveland, O.
Mueller Mfg. Co., Decatur, Ill.
Thompson-Flemming Co., Inc., Buffalo, N. Y.

CURB GUARDS, STEEL

*Godwin Co., W. S., Baltimore, Md.

CURE, STEEL PROTECTED

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Concrete Steel Co., New York.
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Oswego Tool Co., Oswego, N. Y.
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McLeod Co., Cincinnati, O.
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Federal Bridge & Struc. Co., Waukesha, Wis.
Flory Mfg. Co., S., Bangor, Pa.
Inslay Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
Lincoln Iron Works, Rutland, Vt.
National Hoisting Engine Co., Harrison, N. J.
Saenger Derrick Co., Chicago, Ill.
Smith, Whitecomb & Cook Co., Barrie, Ont.
Superior Iron Works, Superior, Wis.

DERRICKS, PIPE LAYING

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Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.

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Lidgerwood Manufacturing Co., New York.
Mueller Mfg. Co., H., Decatur, Ill.

DEMLICKS, REVOLVING

*Terry Mfg. Co., New York.
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Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.

DERRICKS, STEEL

*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Terry Mfg. Co., New York.

American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n., Chicago, Ill.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
Federal Bridge & Struc. Co., Waukesha, Wis.
Hayward Co., New York.
Inslay Mfg. Co., Indianapolis, Ind.

Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill.

DERRICKS, STEEL PORTABLE

*Terry Mfg. Co., New York.
Austin Machinery Corp'n., Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill.

DERRICKS, TRAVELING

*Bay City Dredge Works, Bay City, Mich.
*Terry Mfg. Co., New York.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n., Chicago, Ill.
Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Nat'l Hoisting Engine Co., Harrison, N. J.
Orton Steinbrenner Co., Chicago, Ill.

DISINFECTING CHEMICALS

Barrett Co., New York.
Electro Bleaching Gas Co., New York.
Mathieson Alkali Works, Inc., New York.

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*Koehring Co., Milwaukee, Wis.
Archer Iron Works, Chicago, Ill.
Inslay Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.
Ransome Concrete Machy. Co., Dunellen, N. J.

DITCHING MACHINES (See Excavators, Ditch and Trench)

DOORS, METAL

Central Metal Products Corp., Canton, Ohio.
Dahlgren Metallic Door Co., Jamestown, N. Y.
Friedrich Co., E. H., Holyoke, Mass.
Lawton-Stephens Co., Brooklyn, N. Y.
McFarland Co., J. C., La Porte, Ind.
Penn Metal Co., Boston, Mass.
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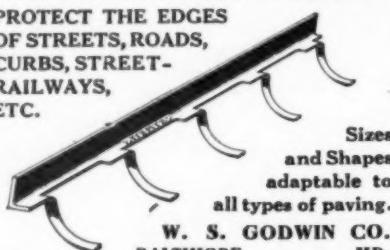


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- GARBAGE CANS. (See Cans)**
- GARBAGE DISPOSAL**
 Balmer Corp., New York.
 Cowell Corp., Cleveland, O.
 Cummer & Son Co., F. P., Cleveland, O.
 Decarie Incinerator Co., Minneapolis, Minn.
 Destructor Co., New York.
 Jeffrey Manufacturing Co., Columbus, O.
 Morse-Boulier Destructor Co., New York.
 Nyo Odorless Crematory Co., Macon, Ga.
- *Austin Western Road Mch. Co., Chicago, Ill.
 *Autocar Co., Ardmore, Pa.
 *Heil Co., Milwaukee, Wis.
 Federal Motor Truck Co., Detroit, Mich.
 Four Wheel Drive Auto Co., Clintonville, Wis.
 Holzboog & Bro. Geo. H., Jeffersonville, Ind.
 International Motor Co., New York.
 Lee Trailer & Body Co., Chicago, Ill.
 Service Motor Truck Co., Wabash, Ind.
 Tiffin Wagon Co., Tiffin, O.
 Watson Products Corp., Canastota, N. Y.
 White Co., Cleveland, O.
- GAS ENGINES. (See Engines, Gas and Gasoline.)**
- GAS METERS**
 Builders Iron Foundry, Providence, R. I.
 General Electric Co., Schenectady, N. Y.
 Pittsburgh Meter Co., East Pittsburgh, Pa.
- GAS PRODUCERS**
 Camden Iron Works, Camden, N. J.
 Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
- GASOLINE STORAGE TANKS**
 *Heil Co., Milwaukee, Wis.
 *Littleford Bros., Cincinnati, O.
 Biggs Boiler Works, Akron, Ohio.
 Bowser & Co., Inc., S. F., Fort Wayne, Ind.
 Byers Machine Co., Ravenna, Ohio.
 Chicago Bridge & Iron Works, Chicago, Ill.
 Honhorst Co., Jas., Cincinnati, O.
 Seafie & Sons, Wm. B., Oakmont, Pa.
 United Iron Works, Kansas City, Mo.
 Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.
- GATES, SLUICE**
 Chapman Valve Mfg. Co., Indian Orchard, Mass.
 Coffin Valve Co., Boston, Mass.
 Goldwell-Wilcox Co., Newburgh, N. Y.
 Columbian Iron Works, Chattanooga, Tenn.
 Crane Co., Chicago, Ill.
 Eddy Valve Co., Waterford, N. Y.
 Hardesty Mfg. Co., T. Donver, Col.
 Kennedy Valve Mfg. Co., Elmira, N. Y.
 Ludlow Valve Mfg. Co., Troy, N. Y.
 Rensselaer Valve Co., Troy, N. Y.
 Wood & Co., R. D., Philadelphia, Pa.
- GAUGES, RECORDING, PRESSURE, STEAM**
 Ashcroft Mfg. Co., Bridgeport, Conn.
 Bristol Co., Waterbury, Conn.
 Crosby Steam Gauge & Valve Co., Boston, Mass.
 Marsh & Co., Jas. P., Chicago, Ill.
 Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
 U. S. Gauge Co., New York
- GAUGES, WATER**
 Bristol Co., Waterbury, Conn.
 Clow & Sons, J. B., Chicago, Ill.
 Lunkhenheimer Co., Cincinnati, O.
 United States Gauge Co., New York.
 Walworth Mfg. Co., Boston, Mass.
- GAUGES, SURFACE, RESERVOIR AND SPECIAL**
- WATER-WORKS**
 *Clark Co., H. W., Mattoon, Ill.
 Builders Iron Foundry, Providence, R. I.
 Simplex Valve & Meter Co., Philadelphia, Pa.
- GLASS, FIREPROOF. (See Wire Glass.)**
- GRADERS, ROAD**
 *Austin-Western Road Mch. Co., Chicago, Ill.
 *Baker Mfg. Co., Springfield, Ill.
 *Good Roads Mach'y Co., Kennett Square, Pa.
 *Holt Mfg. Co., Peoria, Ill.
 *Koehring Co., Milwaukee, Wis.
- *Bussell Grader Mfg. Co., Minneapolis, Minn.
 Adams & Co., J. D., Indianapolis, Ind.
 Case Threshing Machine Co., J. L., Racine, Wis.
 Galion Iron Works & Mfg. Co., Galion, Ohio.
 Kilbourne & Jacobs Mfg. Co., Columbus, O.
 Lyle Culv & Rd. Equip. Co., Minneapolis, Minn.
 Stockland Road Machine Co., Minneapolis, Minn.
- GRADER BLADES**
 *Shunk Mfg. Co., Bucyrus, Ohio.
- GRINDERS AND SAND RAMMERS**
 Chicago Pneumatic Tool Co., New York.
 Cleveland Pneumatic Tool Co., Cleveland, Ohio.
 Ingersoll-Rand Co., New York, N. Y.
- GYPSUM PRODUCTS**
 U. S. Gypsum Co., Chicago, Ill.
- HAMMER DRILLS**
 (See Drills, Hammer.)
- HAMMERS, STEAM, PILE. (See Pile Hammers, Steam)**
- HEAT INSULATING MATERIAL**
 *Carey Co., Philip, Cincinnati, Ohio.
 Johns-Manville, Inc., New York.
- HEATERS AND DISTRIBUTORS, TAR AND ASPHALT HEATING KETTLES**
 *Kinney Mfg. Co., Boston, Mass.

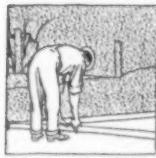
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Everett-Seattle Highway

Carey
Elastite
PROVED AND
ACCEPTED
EXPANSION
JOINT

These eight separate operations are necessary
in making a "poured" expansion joint

Setting spacing-strips
in placeRemoving spacing-strips
after concrete is poured

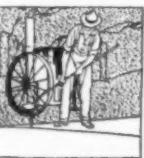
Repairing broken edges



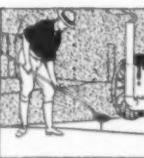
Cleaning joint opening



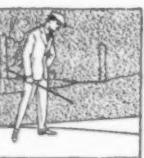
Heating joint filler



Pouring joint



Repouring low joints



Inspection

Elastite Expansion Joint is installed by one man at a single operation. A big saving and a better joint

Saves eight operations in one operation



WHEN Elastite is set in place the joint is done! An Elastite joint is finished in less time than it takes to get ready to pour a "poured joint."

The tar and kettle gang is unnecessary when you use Elastite. All the work is kept up front. No spacing strips are used. No joint openings to clean out. A perfect joint is secured without back-tracking. The job moves ahead faster with less inspecting and superintending.

Use Elastite wherever an expansion joint is necessary to protect the construction from injury due to temperature changes.

Send for sample and prices

THE PHILIP CAREY COMPANY

9 Wayne Avenue, Lockland
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3-22



Elastite is made in widths, lengths and thicknesses as required, can be cut to crown or in any special shape and comes to the job ready to use.

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Where to Purchase

21

HEATING KETTLES. (See Kettles)

HOISTS, BELT-DRIVEN

- *Pawling & Harnischfeger Co., Milwaukee, Wis.
- *Weller Mfg. Co., Chicago, Ill.
- American Hoist & Derrick Co., St. Paul, Minn.
- Dobie Flyer & Mach. Co., Niagara Falls, N. Y.
- Lidgerwood Mfg. Co., New York.
- Mundy Hoisting Engine Co., J. S. Newark, N. J.

HOISTS, CONCRETE, TOWER

- Inslay Mfg. Co., Indianapolis, Ind.
- Lakewood Engineering Co., Cleveland, O.
- Ransome Concrete Machy. Co., Dunellen, N. J.

HOISTS, ELECTRIC

- *Pawling & Harnischfeger Co., Milwaukee, Wis.
- American Hoist & Derrick Co., St. Paul, Minn.
- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Clyde Iron Works Sales Co., Duluth, Minn.
- Dobie Flyer & Mach. Co., Niagara Falls, N. Y.
- Flory Mfg. Co., S. Bangor, Pa.
- Lidgerwood Mfg. Co., New York.
- Link-Belt Co., Chicago, Ill.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Mundy Hoisting Eng. Co., J. S. Newark, N. J.
- National Hoisting Engine Co., Harrison, N. J.
- Patten Mfg. Co., Chattanooga, Tenn.
- Treadwell Eng. Co., Easton, Pa.

HOISTS, GASOLINE

- *Pawling & Harnischfeger Co., Milwaukee, Wis.
- American Cement Mach. Co., Keokuk, Ia.
- Austin Machinery Corp'n., Chicago, Ill.
- Buffalo Hoist & Derrick Co., Buffalo, N. Y.
- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Clyde Iron Works Sales Co., Duluth, Minn.
- Construction Machy. Co., Waterloo, Iowa.
- Domestic Engine & Pump Co., Shippensburg, Pa.
- Flory Mfg. Co., S. Bangor, Pa.
- Lansing Co., Lansing, Mich.
- Lidgerwood Mfg. Co., New York.
- Monighan Machine Co., Chicago, Ill.
- Mundy Hoisting Engine Co., J. S. Newark, N. J.
- National Hoisting Engine Co., Harrison, N. J.
- Novo Engine Co., Lansing, Mich.
- O. K. Clutch & Mach. Co., Columbia, Pa.
- Orr & Sembower, Reading, Pa.
- Patten Mfg. Co., Chattanooga, Tenn.
- Schramm & Son, Inc., Chris. D., West Chester, Pa.

- Standard Scale & Supply Co., Pittsburgh, Pa.

HOISTS, PNEUMATIC

- *Denver Rock Drill Mfg. Co., Denver, Colo.
- Chicago Pneumatic Tool Co., New York.
- Detroit Hoist & Machine Co., Detroit, Mich.
- Flory Mfg. Co., S. Bangor, Pa.
- Hanna Eng. Works, Chicago, Ill.
- Independent Pneumatic Tool Co., Chicago, Ill.
- Ingersoll-Rand Co., New York.
- Northern Engineering Works, Detroit, Mich.
- Worthington Pump & Machy. Corp., New York.

HOISTS, STEAM

- *Denver Rock Drill Mfg. Co., Denver, Colo.
- American Hoist & Derrick Co., St. Paul, Minn.
- Austin Machinery Corp'n., Chicago, Ill.
- Byers Machine Co., Ravenna, Ohio.
- Clyde Iron Works Sales Co., Duluth, Minn.
- Flory Mfg. Co., S. Bangor, Pa.
- Hardie-Turnes Mfg. Co., Birmingham, Ala.
- Ingersoll-Rand Co., New York.
- Inslay Mfg. Co., Indianapolis, Ind.
- Lidgerwood Mfg. Co., New York.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Mundy Hoisting Eng. Co., J. S. Newark, N. J.
- National Hoisting Engine Co., Harrison, N. J.
- Orr & Sembower, Reading, Pa.
- Treadwell Eng. Co., Easton, Pa.

HOISTS FOR MOTOR TRUCKS

- *Hell Co., The Milwaukee, Wis.
- Horizontal Hydr. Hoist Co., Detroit, Mich.
- Perfection Hoist & Engine Co., Two Rivers, Wis.
- Wood Hydr. Hoist & Body Co., Detroit, Mich.

HOLLOW TILE

- *Delaware Clay Products Co., Pittsburgh, Pa.
- Bannon Pipe Co., Louisville, Ky.
- Dee Co., Wm. E., Chicago, Ill.
- Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
- Medal Paving Brick Co., Cleveland, Ohio.
- Metropolitan Paving Brick Co., Canton, Ohio.
- National Fireproofing Co., Pittsburgh, Pa.

HOPPERS, CONCRETE

- *Kochring Co., Milwaukee, Wis.
- *Littleford Bros., Cincinnati, O.
- *Weller Mfg. Co., Chicago, Ill.
- Inslay Mfg. Co., Indianapolis, Ind.

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- Lakewood Engineering Co., Cleveland, O.
- Ransome Concrete Machy. Co., Duncien, N. J.

HOSE, AIR

- Cincinnati Rubber Mfg. Co., Cincinnati, O.
- Goodyear Tire & Rubber Co., Akron, O.
- Ingersoll-Rand Co., New York.
- Perma Flexible Metallic Tubing Co., Phila., Pa.
- Kepusich Rubber Co., Youngstown, O.
- U. S. Rubber Co., New York

HOSE, FIRE

- Bi-Lateral Fire Hose Co., Chicago, Ill.
- Fabric Fire Hose Co., New York.
- Goodrich Rubber Co., B. F., Akron, Ohio.
- Goodyear Tire & Rubber Co., Akron, Ohio.
- U. S. Rubber Co., New York.

- HOUSES, PORTABLE.** (See Buildings, Portable) **HYDRAULIC, FIRE**

- Chapman Valve Mfg. Co., Indian Orchard, Mass.
- Columbian Iron Works, Chattanooga, Tenn.
- Darling Valve & Mfg. Co., Williamsport, Pa.
- Eddy Valve Mfg. Co., Waterford, N. Y.
- Iowa Valve Co., Okaloosa, Ia.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Ludlow Valve Mfg. Co., Troy, N. Y.
- Norwood Engineering Co., Florence, Mass.
- Rensselaer Valve Co., Troy, N. Y.
- Smith Mfg. Co., A. P., East Orange, N. J.
- Wood & Co., R. D., Philadelphia, Pa.

- INCINERATORS, GARBAGE.** (See Garbage Disposal)

INDICATOR POSTS. (See Valves)

INSPECTING LABORATORIES

- *Gulick-Henderson Co., New York.
- Allentown Testing Laboratories, Allentown, Pa.
- Conard & Busby, Burlington, N. J.
- Hunt & Co., Robert W., Chicago, Ill.
- Pittsburgh Testing Laboratories, Pittsburgh, Pa.

INSTRUMENTS AND SUPPLIES. (Surveyors' and Engineers')

- Ainworth & Sons, Wm., Denver, Col.
- Aloe Co., A. S., St. Louis, Mo.
- Berger & Sons, C. L., Boston, Mass.
- Breslau & Sons Mfg. Co., Brooklyn, N. Y.
- Buff & Buff Mfg. Co., Boston, Mass.
- Dietzgen Co., Eugene, Chicago, Ill.
- Gurley, W. & L. E., Troy, N. Y.
- Kaufel & Esser Co., Hoboken, N. J.
- Kolesch & Co., New York.
- Lists Co., A., San Francisco, Cal.
- Lempold & Voelpel, Portland, Ore.
- Pfister, Wm. H., Cincinnati, O.
- Ulmer, J. C. Co., Cleveland, Ohio.
- Weber & Co., F., Philadelphia, Pa.
- White Co., David, Milwaukee, Wis.
- Wisler Instrument Co., St. Louis, Mo.

IRON WORK, STRUCTURAL AND ORNAMENTAL (See Bridges and Buildings)

JACKS, LIFTING

- *McKiernan-Terry Drill Co., New York.
- Buda Company, Chicago, Ill.
- Duff Mfg. Co., Pittsburgh, Pa.
- Joyce-Cridland Co., Dayton, O.
- Kalamazoo Railway Supply Co., Kalamazoo, Mich.
- Norton, Inc. A. O., Boston, Mass.
- Reed Mfg. Co., Pittsburgh, Pa.
- Watson-Millman Company, New York.

JACKS, PIPE FORCING

- *Clark Co., H. W., Mattoon, Ill.

- Duff Mfg. Co., Pittsburgh, Pa.

JAIL AND PRISON WORK

- Barnum Iron Works, E. T., Detroit, Mich.
- Pauli Jail Bldg. Co., St. Louis, Mo.
- Stewart Iron Works Co., Cincinnati, Ohio.
- Van Dorn Iron Works Co., Cleveland, O.

JOINTS, EXPANSION PAVING

- *Carey Company, Philip, Cincinnati, O.

- *Pioneer Asphalt Co., Lawrenceville, Ill.

- *Servicized Products Co., Chicago, Ill.

- *Waring-Underwood Co., Philadelphia, Pa.

JOINTS, FLEXIBLE PIPE. (See Flexible Joints.)

KETTLES, FOR ASPHALT AND TAR HEATING

- *Acme Road Mach. Co., Frankfort, N. Y.
- *Barber Asphalt Co., Philadelphia, Pa.
- *Convery & Co., Inc., Philadelphia, Pa.
- *Good Roads Machinery Co., Kennett Square, Pa.
- *Kinney Mfg. Co., Boston, Mass.
- *Littleford Bros., Cincinnati, O.
- Hausch Mfg. Co., Brooklyn, N. Y.
- Honhorst Co., Jos., Cincinnati, Ohio.
- MacLeod Co., Cincinnati, O.
- Stuebner Iron Wks., G. L., Long Island City, N. Y.
- Tarrant Mfg. Co., Saratoga Springs, N. Y.

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WELLER CONVEYORS FOR HANDLING ALL KINDS OF MATERIALS

MINSTER GASOLINE LOCOMOTIVES FOR SERVICE AND LASTING ECONOMY



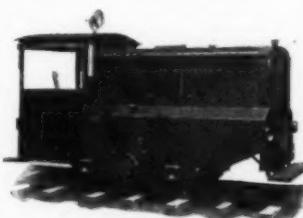
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Experience, The Best of Material, Careful Workmanship, and Rigid Inspection warrant your confidence in our Equipment.

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Model "F"—Seven Ton operating at Beaver Creek Crushing Plant, Celina, Ohio. Mr. John W. Karch, Manager, says: "Production has increased 25% since we put the 'Minster' to work."



MODEL "F"
Made in 6, 7 and 8 Ton Sizes.

Where to Purchase

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LATH, METAL

- *Truscon Steel Co., Youngstown, O.
- Bergen Mfg. Co., Canton, O.
- Bostwick Steel Lath Co., Niles, O.
- Consol. Expanded Metal Co., Braddock, Pa.
- Corrugated Bar Co., Inc., Buffalo, N. Y.
- General Fireproofing Co., Youngstown, O.
- Milwaukee Corrugating Co., Milwaukee, Wis.
- Northwestern Expanded Metal Co., Chicago, Ill.
- Penn Metal Co., Boston, Mass.
- Sykes Metal Lath & Roofing Co., Niles, O.
- Wickwire Spencer Steel Corp., Worcester, Mass.
- Youngstown Pressed Steel Co., Warren, O.

LAWN MOWERS

- Coldwell Lawn Mower Co., Newburgh, N. Y.
- Gilson Mfg. Co., Port Washington, Wis.
- Ideal Power Lawn Mower Co., Lansing, Mich.
- Jacobsen Mfg. Co., Racine, Wis.
- Penna. Lawn Mower Works, Philadelphia, Pa.
- Philadelphia Lawn Mower Co., Philadelphia, Pa.
- Townsend Co., S. P., Bloomfield, N. J.
- Worthington Mower Co., Shawnee, Pa.

LEADITE

- Leadite Co., The, Philadelphia, Pa.

LEAD-MELTING FURNACES

- Bernz, Otto, Co., Newark, N. J.
- Chicago Flexible Shaft Co., Chicago, Ill.
- Gilbert & Barker Mfg. Co., Springfield, Mass.
- Hauk Mfg. Co., Brooklyn, N. Y.
- Stuebner Iron Works, Long Island City, N. Y.

LEAK FINDERS

- *Clark & Co., H. W., Mattoon, Ill.
- *Pitometer Company, New York.

LETTERS AND FIGURES, METAL

- Niagara Metal Stamp Corp., Niagara Falls, N. Y.

LIGHTS, CONTRACTORS

- Carbie Mfg. Co., Duluth, Minn.
- General Electric Co., Schenectady, N. Y.
- Hauk Mfg. Co., Brooklyn, N. Y.
- Macleod Co., Cincinnati, O.
- Milburn Co., Alex., Baltimore, Md.
- Prest-O-Lite Co., Inc., New York

LIGHTING STANDARDS. (See Street Lamp Posts)

LIQUID CHLORINE

- Electro Bleaching Gas Co., New York.
- Mathieson Alkali Works, Inc., New York.
- Penna. Salt Mfg. Co., Philadelphia, Pa.
- LOADERS, GRAVEL, WAGON, CAR, ETC.**
- *Bay City Dredge Works, Bay City, Mich.
- *Hains Mfg. Co., Geo., New York.
- *Sauerman Bros., Chicago, Ill.
- *Smith Co., T. L., Milwaukee, Wis.
- *Weller Mfg. Co., Chicago, Ill.
- Atlas Engineering Co., Milwaukee, Wis.
- Austin Machinery Corp'n, Chicago, Ill.
- Bacon Co., Edw. R., San Francisco, Cal.
- Barber-Greene Co., Aurora, Ill.
- Bonney Supply Co., Inc., Rochester, N. Y.
- Chain Belt Co., Milwaukee, Wis.
- Economy Excavator Co., Iowa Falls, Iowa.
- Fairfield Engineering Co., Lancaster, Ohio.
- Gifford-Wood Co., Hudson, N. Y.
- Jeffrey Mfg. Co., Columbus, O.
- Lee Trailer & Body Co., Chicago, Ill.
- Link-Belt Co., Chicago, Ill.
- Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
- Portable Mchly. Co., Passaic, N. J.
- Sackett Screen & Chute Co., H. B., Chicago, Ill.

LOCK BAR STEEL PIPE

- East Jersey Pipe Co., New York.

LOCKERS, STEEL

- Hart & Hutchinson Co., New Britain, Conn.
- Medart Mfg. Co., Fred., St. Louis, Mo.
- LOCOMOTIVES, FOR CONTRACTORS, ETC.**
- Koppel Industrial Car & Equip. Co., Koppel, Pa.
- *Porter Co., H. K., Pittsburgh, Pa.
- *Whitcomb Co., Geo. D., Rochelle, Ill.
- American Locomotive Co., New York, N. Y.
- Austin Machinery Corp'n, Chicago, Ill.
- Baldwin Locomotive Works, Philadelphia, Pa.
- Brookville Track & Tractor Co., Brookville, Pa.
- Burton Eng. & Mach. Co., Cincinnati, O.
- Craspter, Herbert, New York.
- Davenport Locomotive Works, Davenport, Ia.
- Fate-Root-Heath Co., Plymouth, O.
- Hadfield-Penfield Steel Co., Bucyrus, O.
- Industrial Equipment Co., Inc., Minster, Ohio.
- Light Railway Equip. Co., Philadelphia, Pa.
- Lima Locomotive Wks., Lima, O.
- Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
- Vulcan Iron Works, Wilkes-Barre, Pa.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

LUMBER, HEAVY CONSTRUCTION

- Brown Co., Portland, Me.

- Crowell & Spencer Lumber Co., Long Leaf, La.
- Great Southern Lumber Co., Egalusa, La.
- Industrial Lumber Co., Elizabeth, La.
- Long Bell Lumber Co., Kansas City, Mo.
- Sargent Lumber Co., Little Rock, Ark.
- Sternier Co., Inc., E. J., New York.
- Weyerhaeuser Sales Co., Spokane, Wash.

LUMBER, STEEL

- *Truscon Steel Co., Detroit, Mich.
- Berger Mfg. Co., Canton, O.
- General Fireproofing Co., Youngstown, O.
- National Pressed Steel Co., Massillon, O.
- Northwestern Exp. Metal Co., Chicago, Ill.

METAL LATH. (See "Lath")

METAL ROOFING (See "Roofing")

METER BOXES

- *Clark Co., H. W., Mattoon, Ill.
- Clow & Sons, J. B., Chicago, Ill.
- Columbian Iron Works, Chattanooga, Tenn.
- Ford Meter Box Co., Wabash, Ind.
- Foundry Mfg. Co., St. Albans, Vt.
- Mueller Mfg. Co., H., Decatur, Ill.
- McNutt Meter Box Co., Brasil, Ind.
- Pittsburgh Meter Co., E. Pittsburgh, Pa.
- S. E. T. Valve & Hydrant Co., New York.

METER COUPLINGS

- *Clark Co., H. W., Mattoon, Ill.
- *Neptune Meter Co., New York.
- *Union Water Meter Co., Worcester, Mass.
- Ford Meter Box Co., Wabash, Ind.
- Mueller Mfg. Co., H., Decatur, Ill.
- Pittsburgh Meter Co., E. Pittsburgh, Pa.

METER TESTERS

- *Clark Co., H. W., Mattoon, Ill.
- *Neptune Meter Co., New York.
- Buffalo Meter Co., Buffalo, N. Y.
- Ford Meter Box Co., Wabash, Ind.
- Mueller Mfg. Co., H., Decatur, Ill.
- National Meter Co., New York.
- Pittsburgh Meter Co., E. Pittsburgh, Pa.

METERS, ELECTRIC (WATTHOUR)

- Duncan Elec. Mfg. Co., LaFayette, Ind.
- General Electric Co., Schenectady, N. Y.
- Sangamo Electric Co., Springfield, Ill.
- Westinghouse Elec. & Mfg. Co., E. Pittsburgh Pa.

METERS, WATER

- *Badger Meter Mfg. Co., Milwaukee, Wis.
- *Neptune Meter Co., New York.
- *Union Water Meter Co., Worcester, Mass.
- Builders Iron Fdry., Providence, R. I.
- Buffalo Meter Co., Buffalo, N. Y.
- Gamon Meter Co., Newark, N. J.
- Hersey Mfg. Co., Boston, Mass.
- National Meter Co., New York.
- Pittsburgh Meter Co., E. Pittsburgh, Pa.
- Simplex Valve & Meter Co., Philadelphia, Pa.
- Thomson Meter Co., Brooklyn, N. Y.
- Worthington Pump & Mchly. Corp., New York.

MIXERS, CONCRETE. (See Concrete Mixers.)

MIXERS, GROUT

- American Cement Mchly. Co., Keokuk, Ia.
- Kent Machine Co., Kent, O.
- Lakewood Engineering Co., Cleveland, O.
- Union Iron Works, Inc., Hoboken, N. J.

MIXERS, HOT

- *Barber Asphalt Co., Philadelphia, Pa.
- *Koehring Co., Milwaukee, Wis.
- Austin Machinery Corp'n, Chicago, Ill.
- Kent Machine Co., Kent, O.

MIXERS, MORTAR

- *Knickerbocker Co., Jackson, Mich.
- *Smith Co., T. L., Milwaukee, Wis.
- American Cement Machine Co., Keokuk, Ia.
- Austin Machinery Corp'n, Chicago, Ill.
- Blaw-Knox Co., Pittsburgh, Pa.
- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Construction Machinery Co., Waterloo, Ia.
- Kent Machine Co., Kent, O.
- Lansing Co., Lansing, Mich.
- Lakewood Engineering Co., Cleveland, Ohio.
- Marsh-Capron Co., Chicago, Ill.
- Ransome Concrete Mchly. Co., Dunellen, N. J.
- Standard Scale & Supply Co., Pittsburgh, Pa.

MOTORCYCLES

- Cleveland Motorcycle Co., Cleveland, Ohio.
- Harley-Davidson Motor Co., Milwaukee, Wis.
- Hendee Mfg. Co., Springfield, Mass.

MOTORS, ELECTRIC

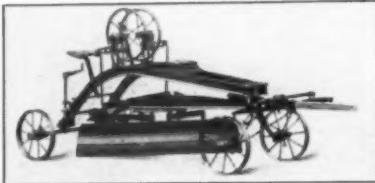
- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- Crocker-Wheeler Co., Amherst, N. J.
- Cutter-Hammer Mfg. Co., Milwaukee, Wis.
- Fairbanks, Morse & Co., Chicago, Ill.

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THE BIG THREE

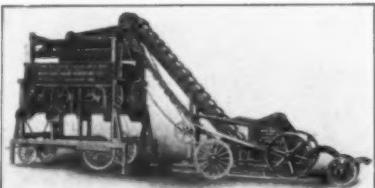
MEN MATERIALS & MACHINERY

were responsible for this road and every other good road ever built. Not the least of these three is Machinery. No road or street can be economically built or maintained without the use of modern machinery.



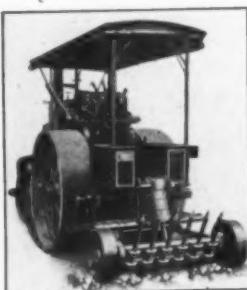
ROAD GRADERS.

A road grader is absolutely necessary in the construction and repair of dirt roads. We make six sizes of Winner Graders, as follows: The Baby Winner with a 5 foot blade; the Winner Patrol with a 6 foot blade; the Little Winner with a 6 foot blade; the Standard Winner with a 7 foot 6 inch blade; the Big Winner with an 8 foot blade, and the Giant Winner with a 10 foot blade.



ROCK CRUSHERS.

Wherever stone is available a rock crusher should be used. We furnish complete rock crushing outfits, portable or stationary, with capacities ranging from 50 to 1000 tons daily. Complete outfits consisting of crusher, elevator, screen, bin, power, etc., designed, built and installed.



ROAD ROLLERS.

The Monarch Steam Road Roller is a high class, standard roller made in 10 and 12 ton sizes. Rollers have ample engine and boiler power. They are flexible, dependable and extremely serviceable. Furnished with or without steam scarifiers.

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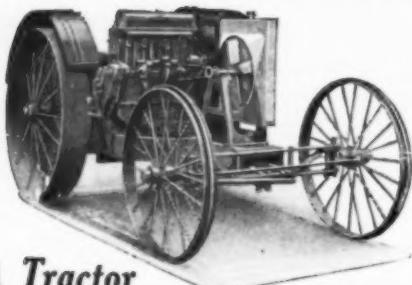
PENNSYLVANIA

Where to Purchase

25

- General Electric Co., Schenectady, N. Y.**
 Holtzer-Cabot Elec. Co., Boston, Mass.
 Lincoln Elec. Co., Cleveland, O.
 Robbins & Myers Co., Springfield, O.
 Wagner Elec. Mfg. Co., St. Louis, Mo.
 Westinghouse Elec. & Mfg. Co., E. Pittsburgh,
 Pa.
- MOTORS, GASOLINE**
 Buda Co., Harvey, Ill.
 Climax Engineering Co., Clinton, Ia.
 Continental Motors Corp., Detroit, Mich.
 Herschell-Spillman Co., No. Tonawanda, N. Y.
 Hinkley Motors, Inc., Detroit, Mich.
 Van Blerck Motor Co., Monroe, Mich.
 Waukesha Motor Co., Waukesha, Wis.
 Wisconsin Motor Mfg. Co., Milwaukee, Wis.
- MOTOR TRUCKS**
 *Autocar Co., Ardmore, Pa.
 *General Motors Truck Co., Pontiac, Mich.
 Acaison Motor Truck Co., Detroit, Mich.
 Acme Motor Truck Co., Cadillac, Mich.
 All American Truck Co., Chicago, Ill.
 Atterbury Motor Car Co., Buffalo, N. Y.
 Avery Co., Peoria, Ill.
 Bessemer Motor Truck Co., Grove City, Pa.
 Brockway Motor Truck Co., Cortland, N. Y.
 Clydesdale Motor Truck Co., Clyde, O.
 Corbitt Motor Truck Co., Henderson, No. Car.
 Denby Motor Truck Co., Detroit, Mich.
 Diamond T. Motor Car Co., Chicago, Ill.
 Duplex Truck Co., Lansing, Mich.
 Federal Motor Truck Co., Detroit, Mich.
 Four Wheel Drive Auto Co., Clintonville, Wis.
 Garford Motor Truck Co., Lima, O.
 Gramm Bernstein Motor Truck Co., Lima, O.
 Indiana Truck Corp'n., Marion, Ind.
 International Motor Co., New York.
 Jackson Motors Corp'n., Jackson, Mich.
 Kelly Springfield Motor Truck Co., Springfield, O.
 Kissel Motor Car Co., Hartford, Wis.
 Larrabee-Deyo Motor Tr. Co., Binghamton, N.Y.
 Nash Motors Co., Kenosha, Wis.
 Nelson Motor Truck Co., Saginaw, Mich.
 Oshkosh Truck Sales & Finance Corp., Oshkosh,
 Wis.
- Packard Motor Car Co., Detroit, Mich.
 Pierce Arrow Motor Car Co., Buffalo, N. Y.
 Republic Motor Truck Co., Alma, Mich.
 Rowe Motor Mfg. Co., Lancaster, Pa.
 Selden Truck Corp'n., Rochester, N. Y.
 Service Motor Truck Co., Wabash, Ind.
 Sterling Motor Truck Co., Milwaukee, Wis.
 Stewart Motor Corp'n., Buffalo, N. Y.
 Tiffin Wagon Co., Tiffin, O.
 Titan Motor Truck Co., Milwaukee, Wis.
 Traffic Motor Truck Co., St. Louis, Mo.
 Transport Truck Co., Mt. Pleasant, Mich.
 U. S. Motor Truck Co., Cincinnati, O.
 Velle Motors Corp'n., Moline, Ill.
 Ward LaFrance Truck Co., Elmira, N. Y.
 Watson Products Corp'n., Canastota, N. Y.
 Wilson Co., J. C., Detroit, Mich.
 White Co., Cleveland, Ohio.
 Winther Motors, Inc., Kenosha, Wis.
- MOULDS, CONCRETE**
 Blaw-Knox Co., Pittsburgh, Pa.
 Hydraulic Steelcraft Co., Cleveland, O.
- OAKUM**
 Wall Rope Works, Beverly, N. J.
- OILS, ROAD**
 *Barber Asphalt Co., Philadelphia, Pa.
 *Pioneer Asphalt Co., Lawrenceville, Ill.
 *Standard Oil Co. (Indiana), Chicago, Ill.
 *Texas Company, New York.
 Atlantic Refining & Asphalt Corp'n., Philadelphia
 Barrett Co., New York.
 Headley Good Roads Co., Philadelphia, Pa.
 Pierce Oil Corp., New York.
 Sinclair Refining Co., Chicago, Ill.
 Standard Oil Co., (La.) New Orleans, La.
 Standard Oil Co., (N. J.) Newark, N. J.
 U. R. Asphalt Refining Co., New York.
- OX-YACETYLENE APPARATUS**
 Oxweld Acetylene Co., Newark, N. J.
- OXYGEN**
 Linde Air Products Co., New York.
- PACKING, WATER PIPE**
 *Union Water Meter Co., Worcester, Mass.
 Leadite Co., The, Philadelphia, Pa.
 United Lead Company, New York.
- PAINTS, METAL PROTECTION**
 *Barber Asphalt Co., Philadelphia, Pa.
- *Dixon Crucible Co., Jos., Jersey City, N. J.
 *Truscon Laboratories, Detroit, Mich.
 Acme White Ld. & Col. Works, Detroit, Mich.
 Barrett Co., New York.
 Berry Bros., Detroit, Mich.
 Cook Paint & Varnish Co., Kansas City, Mo.
 Detroit Graphite Co., Detroit, Mich.
 Detroit White Lead Wks., Detroit, Mich.
 Du Pont de Nemours & Co., Inc., E. I., Wilming-
 ton, Del.
 Longman & Martines, New York.
 Martin-Senour Co., Chicago, Ill.
 Minwax Co., New York.
 Protexol Corp., New York.
 Ruberoid Co., New York.
 Semet-Solvay Co., Syracuse, N. Y.
 Sherwin-Williams Co., Cleveland, O.
 Sonnenberg Sons, Inc., L., New York.
 Toco Bros., New York.
 Tropical Paint & Oil Co., Cleveland, Ohio.
- PAPERS, BLUE PRINT AND BROWN PRINT**
 Indianapolis Blue Print & Supply Co., In-
 dianapolis, Ind.
- PAPER, BUILDING, ROOFING, ETC.**
 *Barber Asphalt Co., Philadelphia, Pa.
 *Carey Co., Philip, Cincinnati, O.
 Barrett Co., New York.
 Bird & Son, Inc., E. Walpole, Mass.
 Brown Co., Portland, Me.
 Hydrex Asphalt Products Corp., New York.
 Johns-Manville, Inc., New York.
 National Roofing Co., Tonawanda, N. Y.
 Ruberoid Co., New York.
- PARK BENCHES**
 Art Concrete Works, Pasadena, Calif.
 Bausman Mfg. Co., Bausman, Pa.
 Dow Co., Louisville, Ky.
 Mott Iron Wks., J. L., New York.
 Stewart Iron Works, Cincinnati, Ohio.
- PAVING AND ROAD ROLLERS** (See Road and
 Paving Rollers)
- PAVING BLOCKS, CREOSOTED WOOD**
 American Creosote Wks., Inc., New Orleans, La.
 Creosoted Materials Co., New Orleans, La.
 Jennison-Wright Co., Toledo, O.
 Protexol Corp., New York.
 Republic Creosoting Co., Indianapolis, Ind.
 Wyckoff Pipe & Creosoting Co., New York.
- PAVING BRICK**
 Alton Brick Co., Alton, Ill.
 Barr Clay Co., Streator, Ill.
 Binghamton Brick Co., Binghamton, N. Y.
 Burton Townsend Co., Zanesville, O.
 Flint Brick Co., Des Moines, Ia.
 Hydraulic Press Brick Co., St. Louis, Mo.
 McAvoy Vit. Brick Co., Philadelphia, Pa.
 Mack Mfg. Co., Wheeling, W. Va.
 Mayer Brick Co., C. P., Bridgewater, Pa.
 Medai Paving Brick Co., Cleveland, O.
 Metropolitan Paving Brick Co., Canton, O.
 Murphysboro Paving Brick Co., Murphysboro, Ill.
 Patton Clay Mfg. Co., Patton, Pa.
 Peebles Brick Co., Portsmouth, O.
 Penna. Clay Co., Pittsburgh, Pa.
 Pittsburgh Paving Brick Co., Pittsburgh, Kas.
 Poston Paving Brick Co., Crawfordsville, Ind.
 Purington Paving Brick Co., Galesburg, Ill.
 Southern Clay Mfg. Co., Chattanooga, Tenn.
 Sterling Brick Co., Olean, N. Y.
 Thurber Brick Co., Thurber, Texas.
 Veedersburg Paver Co., Veedersburg, Ind.
- PAVING MACHINERY.** (See Road and Paving
 Machinery)
- PAVING GUARDS, STEEL**
 *Godwin Co., W. S., Baltimore, Md.
- PAVING MATERIALS** (See "Asphalt," "Paving
 Brick," "Granite Block," etc.)
- PAVING MIXERS.** (See Concrete Mixers)
- PAVING TOOLS**
 *Barber Asphalt Co., Philadelphia, Pa.
 *Connery & Co., Inc., Philadelphia, Pa.
 *Littleford Bros. Co., Cincinnati, O.
 Anderson Tool & Sup. Co., W. H., Detroit, Mich.
 Cummer & Sons Co., F. D., Cleveland, O.
 Kramer Bros. Fdry. Co., Dayton, O.
 Union Iron Works, Hoboken, N. J.
 Warren Bros. Co., Boston, Mass.
- PERFORATED METALS**
 Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 Hendrick Mfg. Co., Carbondale, Pa.
- PICKS**
 Hubbard Co., Pittsburgh, Pa.

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A Tractor That Does a Big Day's Work

THE HUBER TRACTOR gets an unusually big day's work done on the roads because it has ample power to pull a heavy grader, making a deep cut, and to keep going even on heavy grades at good speed.

Exceptionally short turning radius combined with high wheels make it easy to maneuver even on rough ground. The tractor attached to grader can turn around on a 34-foot roadbed.

HUBER TRACTORS are made in two sizes for medium and heavy road work.

A Road Roller That Has Made Good

The HUBER ROAD ROLLER is one of the most successful and most universally used pieces of road equipment. It has ample power to pull road-building machinery, and will last for many years in spite of hard use or even abuse.

The Huber scarifier attachment, controlled by steam, can be attached to the roller at the factory or after delivery, making it serve two purposes. The scarifier will dig up the hardest macadam road.

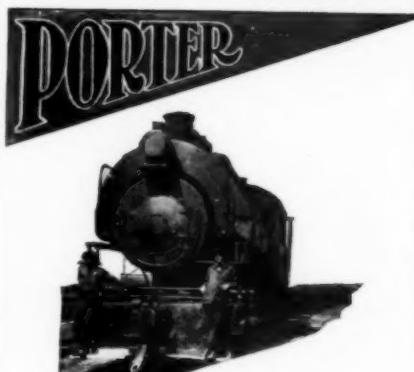
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PITTSBURGH SHOVELS

Made of high grade Carbon Steel manufactured under the finest methods of practical and scientific control.

Equipped with handles of second growth ASH which insure a product of remarkable strength that will outwear three ordinary shovels.

You will make no mistake in ordering a trial dozen to-day.

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Oliver Bldg.,
PITTSBURGH, PA.

Where to Purchase

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- IRON CITY TOOL WORKS**, Pittsburgh, Pa.
 Klein-Logan Co., Pittsburgh, Pa.
 Verona Tool Works, Verona, Pa.
 Warren Tool & Forge Co., Warren, O.
 Warwood Tool Co., Wheeling, W. Va.
- PILE DRIVERS**
 *McKierman-Terry Drill Co., New York.
 Browning Co., Cleveland, O.
 Clyde Iron Works Sales Co., Duluth, Minn.
 Industrial Works, Bay City, Mich.
 Lidgewood Manufacturing Co., New York.
 McMyler Interstate Co., Cleveland, O.
 Union Iron Works, Hoboken, N. J.
- PILE HAMMERS, STEAM**
 *McKierman-Terry Drill Co., New York.
 Clyde Iron Works Sales Co., Duluth, Minn.
 Industrial Works, Bay City, Mich.
 National Hoisting Eng. Co., Harrison, N. J.
 Union Iron Works, Hoboken, N. J.
 Vulcan Iron Works, Chicago, Ill.
- PILING, CONCRETE**
 MacArthur Concrete Pile & Foundation Co., N. Y.
 Raymond Concrete Pile Co., New York.
- PILING, INTERLOCKING STEEL**
 Carnegie Steel Co., Pittsburgh, Pa.
 Jones & Laughlin Steel Co., Pittsburgh, Pa.
 Lackawanna Steel Co., Buffalo, N. Y.
- PIPE, CAST IRON**
 *Central Foundry Co., New York.
 *U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
 American Cast Iron Pipe Co., Birmingham, Ala.
 Claw & Sons, J. B., Chicago, Ill.
 Donaldson Iron Co., Evans, Pa.
 Fox & Co., John, New York.
 Glamorgan Pipe & Fdry. Co., Lynchburg, Va.
 Lynchburg Foundry Co., Lynchburg, Va.
 National Cast Iron Pipe Co., Birmingham, Ala.
 Warren Fdry. & Machine Co., New York.
 Wood & Co., R. D., Philadelphia, Pa.
- PIPE, CULVERT** (See Culverts)
- PIPE, LEAD**
 *United Lead Company, New York.
- PIPE, REINFORCED CONCRETE**
 Concrete Products Co., Pittsburgh, Pa.
 Core Joint Concrete Pipe Co., Baltimore, Md.
 Independent Concrete Pipe Co., Indianapolis, Ind.
- Look Joint Pipe Co., E. Orange, N. J.
 Massey Concrete Products Corp'n, Chicago, Ill.
 United Concrete Pipe Co., New York.
- PIPE, RIVETED STEEL**
 *Connery & Co., Inc., Philadelphia, Pa.
 *Littleford Bros., Cincinnati, Ohio.
 *Weller Mfg. Co., Chicago, Ill.
 Abendroth & Root Mfg. Co., Newburgh, N. Y.
 American Spiral Pipe Works, Chicago, Ill.
 Blaw-Knox Co., Pittsburgh, Pa.
 Canton Culvert & Silo Co., Canton, O.
 Chatta, Boller & Tank Co., Chattanooga, Tenn.
 Chicago Bridge & Iron Works, Chicago, Ill.
 East Jersey Pipe Co., New York.
 Hammond Iron Works, Warren, Pa.
 Hardesty Mfg. Co., R. Denver, Col.
 Honhorst Co., Jos., Cincinnati, Ohio.
 Lancaster Iron Works, Lancaster, Pa.
 Petroleum Iron Works Co., Sharon, Pa.
 Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
 Tippet & Wood, Phillipsburg, N. J.
- PIPE, SPIRAL RIVETED**
 Abendroth & Root Mfg. Co., Newburgh, N. Y.
 American Spiral Pipe Works, Chicago, Ill.
 Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- PIPE, STEEL**
 East Jersey Pipe Co., New York.
 Jones & Laughlin Steel Co., Pittsburgh, Pa.
 National Pipe Co., Pittsburgh, Pa.
 Republic Iron & Steel Co., Youngstown, O.
 Steel & Tube Co. of Am., Chicago, Ill.
 Youngstown Sheet & Tube Co., Youngstown, O.
- PIPE, WOOD**
 American Wood Pipe Co., Tacoma, Wash.
 Continental Pipe Mfg. Co., Seattle, Wash.
 Michigan Pipe Co., Bay City, Mich.
 Pacific Tank & Pipe Co., San Francisco, Cal.
 Redwood Mfrs. Co., San Francisco, Cal.
 Standard Wood Pipe Co., Williamsport, Pa.
 Wyckoff & Sons Co., A., Elmhira, N. Y.
- PIPE, WROUGHT IRON**
 Byers Co., A. M., Pittsburgh, Pa.
 Reading Iron Co., Reading, Pa.
- PIPE BENDING MACHINES**
 Amer. Pipe Bending Mach. Co., Boston, Mass.
 Walworth Mfg. Co., Boston, Mass.
- PIPE COVERING**
- AIRCELL**
 *Carey Co., Philip, Cincinnati, O.
 Ehret Magnesia Mfg. Co., Valley Forge, Pa.
 Johns-Manville, Inc., New York.
 Keasbey & Mattison Co., Ambler, Pa.
 Nat'l Asbestos Co., Jersey City, N. J.
 Norristown Magnesia & Asbestos Co., Norristown, Pa.
 Sall Mt. Co., Chicago, Ill.
 Watson Co., H. F., Erie, Pa.
- 85 PER CENT MAGNESIA**
 *Carey Co., Philip, Cincinnati, O.
 Ehret Magnesia Co., Valley Forge, Pa.
 Johns-Manville, Inc., New York.
 Keasbey & Mattison Co., Ambler, Pa.
- WOOD**
 Continental Pipe Mfg. Co., Seattle, Wn.
 Redwood Mfrs. Co., San Francisco, Cal.
 Kic-Wil Co., Cleveland, O.
 Wyckoff & Son Co., A., Elmhira, N. Y.
- PIPE CUTTERS** (See Cutters, Pipe, Hand.)
- PIPE FITTINGS**
 *Central Foundry Co., New York.
 *U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
 American C. I. Pipe Co., Birmingham, Ala.
 Builders' Iron Fdry., Providence, R. I.
 Claw & Sons, J. B., Chicago, Ill.
 Crane Co., Chicago, Ill.
 Lankenheimer Co., Cincinnati, O.
 Reading Steel Casting Co., Bridgeport, Conn.
 Warren Fdry. & Mach. Co., New York.
 Wood & Co., R. D., Philadelphia, Pa.
- PIPE HANDLING MACHINERY**
 Mueller Mfg. Co., H., Decatur, Ill.
 Taylor Portable Steel Derrick Co., Chicago, Ill.
- PIPE JOINT COMPOUND, SEWER**
 *Carey Co., Philip, Cincinnati, O.
 *Waring-Underwood Co., Philadelphia, Pa.
 Leadite Company, Inc., Philadelphia, Pa.
 Pacific Flush Tank Co., Chicago, Ill.
 Ruberoid Co., New York.
- PIPE JOINT MATERIAL, CAST IRON**
 Lead-Hydro-Tite Co., Boston, Mass.
 Leadite Co., The, Philadelphia, Pa.
 United Lead Co., New York.
- PLAYGROUND APPARATUS**
 American Playground Device Co., Anderson, Ind.
 Everwear Mfg. Co., Springfield, O.
 George, Howard, Philadelphia, Pa.
 Hill Standard Co., Anderson, Ind.
 Medart Mfg. Co., Fred., St. Louis, Mo.
 Spalding & Bros., A. G., Chicago, Mass.
- PLOWS, CONTRACTORS**
 *Burch Plow Works Co., Crestline, O.
 *Holt Mfg. Co., Peoria, Ill.
 *Russell Grader Mfg. Co., Minneapolis, Minn.
 American Steel Scraper Co., Sidney, O.
 Avery Co., Peoria, Ill.
 Deere & Co., Moline, Ill.
 Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
 International Harvester Co., Chicago, Ill.
 Moline Plow Co., Moline, Ill.
 Oliver Chilled Plow Works, South Bend, Ind.
 Sidney Steel Scraper Co., Sidney, O.
 Slusser-McLean Scraper Co., Sidney, O.
 Western Wheeled Scraper Co., Aurora, Ill.
 Wind Plow Co., Batavia, N. Y.
- PLUMBING SUPPLIES**
 Claw & Sons, J. B., Chicago, Ill.
 Crane Co., Chicago, Ill.
 Glauber Brass Mfr. Co., Cleveland, O.
 Mueller Mfg. Co., H., Decatur, Ill.
 Rundle-Spence Mfg. Co., Milwaukee, Wis.
 United Brass Mfg. Co., Cleveland, O.
 Walworth Mfr. Co., Boston, Mass.
- POLES, STEEL STRUCTURAL**
 Blaw-Knox Co., Pittsburgh, Pa.
 Electric Railway Equipment Co., Cincinnati, O.
 Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- PORTABLE BUILDINGS**
 *Littleford Bros., Cincinnati, Ohio.
 *Truscon Steel Co., Youngstown, O.
 Blaw-Knox Co., Pittsburgh, Pa.
 Milwaukee Corrugating Co., Milwaukee, Wis.
 Pruden Co., O. D., Baltimore, Md.
- PORTABLE STEEL DERRICKS** (See Derricks, Steel Portable.)
- PORTLAND CEMENT** (See Cement.)
- POWDER** (See Explosives.)
- PUMPS, AIR LIFT**
 Harris Air Pump Co., Indianapolis, Ind.
 Indiana Air Pump Co., Indianapolis, Ind.

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Established 1892. Representatives throughout the world.



STREET FLUSHERS and SPRINKLERS

Municipal Supply Company
South Bend, Indiana

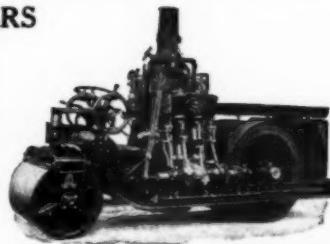
ERIE TANDEM PAVING ROLLERS

Includes everything that makes for the best in Road Rollers. They are strong, simple in construction—durable and economical and easy to operate. Our first roller built in 1887 is still doing its "bit."

Erie Rollers are guaranteed against breakage or wear for 5 years.

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THE ERIE MACHINE SHOPS



ERIE, PA.

Buffalo-Pitts and Kelly-Springfield Rollers—Steam and Motor



All Types and Sizes

With or without Scarifier attachment.

Helps you finish the job on time.

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THE BUFFALO-SPRINGFIELD ROLLER CO.
SPRINGFIELD OHIO

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Where to Purchase

29

Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

PUMPS, BOILER FEED

Advance Pump & Compr. Co., Battle Creek, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Steam Pump Co., Battle Creek, Mich.
Aurora Pump & Mfg. Co., Aurora, Ill.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Works, A. S., New York
Dayton-Dowd Co., Quincy, Ill.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
Lea-Courtenay Co., Newark, N. J.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Northern Fire Apparatus Co., Minneapolis, Minn.
Scranton Pump Co., Scranton, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Vogt Bros. Mfg. Co., Louisville, Ky.
Warren Steam Pump Co., Warren, Mass.
Weinman Pump Mfg. Co., Columbus, O.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL

Keystone Driller Co., Beaver Falls, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Cameron Steam Pump Works, A. S., New York
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Domestic Eng. & Pump Co., Shippensburg, Pa.
Erie Pump & Engine Works, Medina, N. Y.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
Lea-Courtenay Co., Newark, N. J.
Manistee Iron Wks., Manistee, Mich.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinville, N. Y.
Schramm & Son, Inc., Chris. D., West Chester,
Pa.
United Iron Works, Kansas City, Mo.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Machy. Corp., New York.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CONTRACTORS'

*Smith Co., T. L., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Cameron Steam Pump Works, A. S., New York.
Carter Co., Ralph B., New York.
Construction Mach'y Co., Waterloo, Ia.
Dayton-Dowd Co., Quincy, Ill.
Deming Co., Salem, Ohio.
Domestic Engine & Pump Co., Shippensburg, Pa.
Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Works, Medina, N. Y.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Lea-Courtenay Co., Newark, N. J.
McGowan Co., J. H., Cincinnati, O.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinville, N. Y.
New York Eng. Co., New York.
Northern Fire App. Co., Minneapolis, Minn.
Novo Engine Co., Lansing, Mich.
Pulsometer Steam Pump Co., New York.
Schramm & Son, Inc., Chris. D., West Chester,
Pa.

Standard Scale & Supply Co., Pittsburgh, Pa.
Universal Motor Co., Oshkosh, Wis.
Van Nothuys Machine Wks., Albany, N. Y.
Walvo Bros. & Bond Co., Boston, Mass.

PUMPS, DEEP WELL

*Clark Co., H. W., Mattoon, Ill.
*Keystone Driller Co., Beaver Falls, Pa.
Aldrich Pump Co., Allentown, Pa.
American Well Works, Aurora, Ill.
Cameron Steam Pump Works, A. S., New York.
Cook, Inc., A. D., Lawrenceburg, Ind.
Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.

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Goulds Mfg. Co., Seneca Falls, N. Y.
Harris Air Pump Co., Indianapolis, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Layne & Bowler Co., Memphis, Tenn.
Midwest Engine Co., Indianapolis, Ind.
Nordberg Mfg. Co., Milwaukee, Wis.
United Iron Works, Kansas City, Mo.
Weber Subterranean Pump Co., New York.

PUMPS, DREDGING

Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Wks., A. S., New York.
Domestic Eng. & Pump Co., Shippensburg, Pa.
Morris Machine Works, Baldwinville, N. Y.
Rumsey Pump Co., Ltd., Seneca Falls, N. Y.
Wood & Co., R. D., Philadelphia, Pa.
Worthington Pump & Machy. Corp., New York.

PUMPS, GASOLINE AND OIL

*Kinney Mfg. Co., Boston, Mass.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Northern Fire App. Co., Minneapolis, Minn.
Wayne Oil Tank Pump Co., Fort Wayne, Ind.
Worthington Pump & Mach. Corp., New York.

PUMPS, POWER

*Kinney Mfg. Co., Boston, Mass.
*Kehring Co., Milwaukee, Wis.
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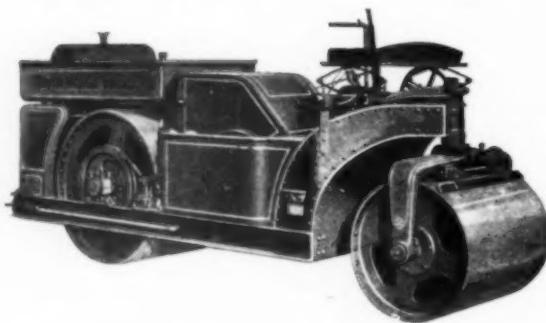
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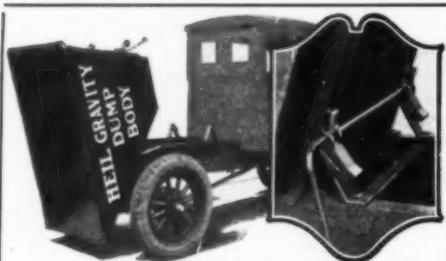
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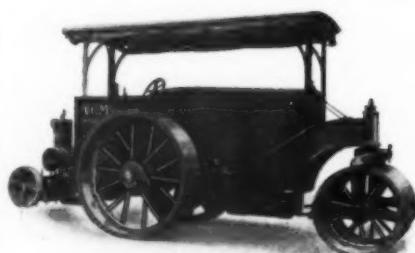
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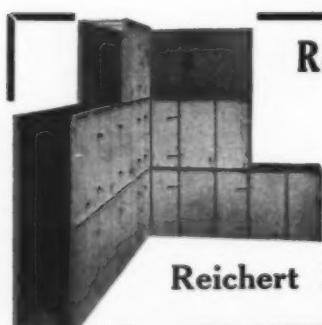
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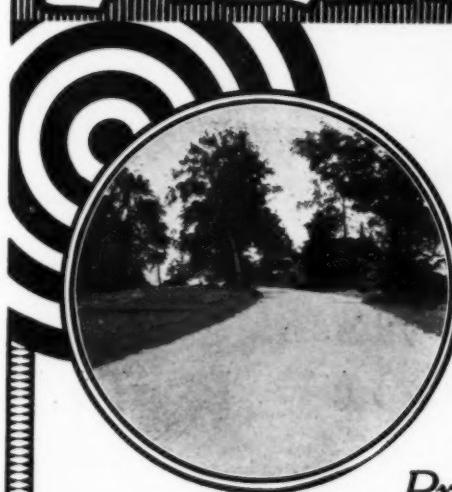
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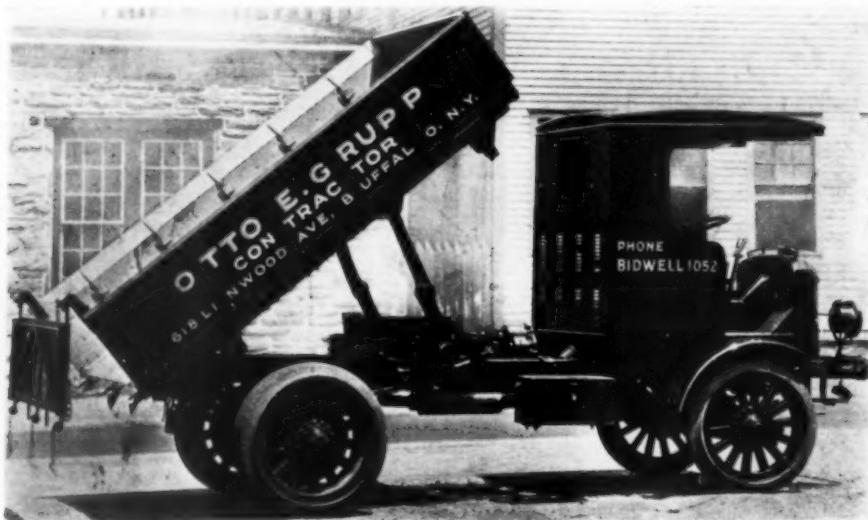
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The 4-Cylinder 5-Ton Heavy Duty Autocar



Ralph Meicht, driver for Otto E. Grupp, contractor, of Buffalo, N. Y., recently wrote us as follows:

"I have had experience with all makes of trucks, and know that the 5-ton Autocar will outpull anything that runs on four wheels. It is very easy on oil and is averaging eight or nine miles per gallon of gas. It is the best truck I have ever driven, handles as easy as a baby carriage and makes short turns. Recently it pulled a five-ton truck loaded with 2500 bricks out of a mud hole and on to a good road. My truck was loaded with 3000 bricks and I hauled him out on second."

The Autocar Company, Ardmore, Pa., Established, 1897

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May, 1922

The Value of Cost Keeping

By Daniel J. Hauer

COST keeping for both contractors and manufacturers has been written of so much during the past decade that many of those who are not keeping costs have gained the impression that it means an expensive and complicated system to install. They say also that, judging from the lack of apparent benefits that have accrued to those who have kept costs, these contractors are no richer or better off than those who have not kept costs.

Contractors are just beginning to realize the value of making inventories and keeping such records as will show all details of work done and the cost of each item. These records must be kept continuously from month to month, week to week, day to day, and even hour to hour. They must cover every detail and be complete as to local conditions, and at times reference may have to be made to specifications and plans.

It makes little difference how complete the records are if they are not used. To be of value, all records must be used, and more especially cost records. Not to use records means that the money and time spent to make them are wasted. This would seem to be a self-evident fact, yet it is quite surprising that thousands of contractors who keep cost data make little use of these records, or, if they do use them, it may be weeks, months or years before the results are made available. A few years ago the writer was talking to one of the leading contractors of New York City and one of the largest and most successful operators in the country, who spoke of two of his engineers who

were then engaged in tabulating cost data of a job he had finished two years previous. From this it was evident that this contractor's organization was accustomed to gather costs just as a man gathers poems and other newspaper articles for a scrap-book and when he has the leisure assorts them and arranges them to his liking. Too many costs are made up like a scrap-book and are not in shape to be used immediately; others are kept in lump sums so that they mean little or nothing, while some records are complete as to the details of cost items, but give no information as to units of work done, so that in the end they are incomplete. Incomplete records are as valueless as no records; in fact, they may be much worse, for they are apt to be misleading.

The value of all cost records is dependent upon the use to which they are put. This, too, should govern the form of collecting and keeping the data, especially as to details. The use of cost records generally considered first and given the greatest value, yet in reality of least importance, is in estimating on new jobs. The second is in making costs an adjunct to book-keeping and separating the costs of materials from that of labor and further subdividing the labor costs between various classes of work, such as excavation, concrete, steel construction, etc. This, too, is of small value, for it is possible to cover all these things in the accounting system. The third and greatest value of cost records is to use them in the management of the work, to determine daily if a profit or a loss

The year 1922 is an opportune time to take an inventory of the past in order to leave sufficient to guide ourselves in the future. We have gone through periods of expansion and inflation as well as depression and deflation. Inventories are all-important in business—inventories of stock on hand, of business, of work done, even of yourself. The men behind the business are as important as the business. Success, especially in times of stress, will be dependent upon these men. Their virtues, character, ability, adaptability to learn, and a hundred other things regarding these men, are either an asset or a liability of the business, as is the ownership of a machine or the owing of a bill.

COST FORMS MENTIONED IN THE TEXT

1—A poor form. 2—Incomplete. 3—For excavation. 4—For a road job. 6—An office form.

accrues, to improve the methods, eliminate wastes and set tasks and award bonuses, if a task and bonus system is used.

If costs are kept for this last purpose, they pay large dividends and can easily be used for the first and second purposes and without much additional work of segregating and analyzing the records. Records kept in this way can be used each day, and not only daily unit costs will be shown, but also man and machine units of work that will be done. These last are of the greatest value in estimating upon new contracts.

An Analysis of Forms

Cost forms cannot be printed stock affairs for

estimating only, this may be true, but for costs kept for improving the management, closer records are necessary and the items must be kept in mills and cents.

Some years ago the writer was doing a large amount of hard excavation. He noticed in one day's work that the picking cost was a little high, only a fraction of a cent. He decided to change his men on picking, and was surprised to find out that by reducing the cost of picking only two mills per cubic yard he reduced the total cost of the excavation nearly two and one-half cents per cubic yard—a decided saving in such a class of work and one that meant doubling the profit on each cubic yard. To

Form 29-146-5-17																							
JOB _____		WEATHER																					
STATION _____		Temperature																					
CONCRETE REPORT																							
FORM WORK (Framing)																							
Form	#	Hrs	Min	Sec	Amount	ft ²	Cost W/M	ft ²	Cost C/Y	Cost	Remarks	#	Hrs	Min	Sec	Amount	ft ²	Cost W/M	ft ²	Cost C/Y	Cost	Remarks	
Foreman												Foreman											
Carpenters												Carpenters											
Men												Men											
Teams												Teams Men											
Extra Men																							
Total												Total											
Remarks												Remarks											
CONCRETE												MATERIALS											
Form	#	Hrs	Min	Sec	Amount	ft ²	Cost C/Y	Cost	Cost	Items	Amount	Rate	Cost	Items	Amount	Rate	Cost						
Foreman										Cement				Cool									
Men Mixing										Sand				Gasoline									
Men Placing										Stone				Oil									
Finishing										Gravel				Waste									
Teams										Water													
Mixer										Steel													
Engineer										Ties													
Total										Lumber													
Remarks												Formas											

FIGURE 5. A WELL-PREPARED FORM FOR CONCRETE WORK

various kinds of work. It is true that forms can be devised which will be applicable to several kinds of work, with but slight variations, as for small buildings, concrete sidewalks, roads and other classes of construction, but—for example—a form that is devised for keeping the cost of excavation for railroad grading may be poorly suited for cost records of sewers, cellar excavation or highway construction.

Many forms used show lump sum costs, but give few data as to details, and such forms may never give accurate enough costs to eliminate wastes. One writer on costs has stated that in keeping records of excavation it is only necessary to consider the cent. If costs are kept for

have kept these costs to the nearest cent would never have permitted the discovery of this waste with the attendant saving; to obtain and realize the real value of cost records, in many cases where costs are low it is necessary to keep account of each mill spent.

Such details cannot be kept and shown on the form illustrated in Figure 1. This is a type of form much used on small building jobs as a daily record. It is frequently termed a cost report, but is simply a time chart from which a pay-roll can be made. A few weeks after this report is made it is likely to be useless, except to the man who made it. Such a report may refresh the foreman's memory so that he could

tell considerable about the day's work, but he too would soon forget the details that the report lacks.

In Figure 2 is illustrated another type of cost form that was devised for a quarry company. This form gives space for listing some details of costs, yet such a form will tell absolutely nothing as to the cost of producing stone for any one particular day. There are two columns, one headed "Expenses," the other "Deliveries." Naturally, the expenses are for the current day, while some of the products delivered that day may have been produced the day before, a week or even a month previous to that date. It would be impossible from this form to tell the cost of producing each day any one of the seven products listed.

At the end of a season, with such a form, it might be possible after some days spent in compilation and analysis to tell something as to the cost of production and if a profit or a loss accrued, long after it was possible to rectify any mistakes. Although the sheet is supposed to show the profit and loss of each day, no one could figure it from such a form. Many examples of poorly devised cost forms could be given, but these should suffice to show that cost keeping of this kind has little value.

It is a difficult job to devise the proper kinds of cost forms, but some idea can be given by illustrating a few that have been in successful use and have given records of real value.

Good Cost Forms

In Figure 3 is shown a combination report for hard excavation and for the quarrying of stone at the ledge by hand. This form could be made to cover only one class of work, and this would make it much simpler, but the general idea is to give field costs only and show in detail the cost of each item of the work. Thus, the cost of loosening is shown under the heading of "Blasting," if it is rock. A separate form is used to show the detail cost of the explosives, the summary going onto this sheet in the fourth column opposite "Explosives." A separate form is also used to keep a record of the rock drilling, the summaries going onto this form. The same thing is true of clearing and grubbing and the blasting of stumps. For earth, the pickers show the cost of loosening,

the shovels the cost of loading, the wheelbarrows, carts, cars or wagons the cost of hauling, and the sump men the cost of dumping. This, with the foreman, would complete the field costs, so that the slightest variation in the costs could be noted. If scrapers are used, the same costs can be shown as loosening, loading, hauling and dumping. The class of material excavated is noted, the length of haul, the number of cubic yards, weather, and all other conditions that affect the cost. Each item of cost can be figured down to the mill, and the gross cost totaled.

In Figure 4 is shown a form for bituminous road work figured out to show the cost by the linear foot, square yard or ton, for each course. The same detail can be obtained as in other classes of work.

Few people keep concrete costs properly so that the details can be known. The form shown in Figure 5 is devised first to show the cost of framing for the forms in feet board measure, converting these costs to the cubic yard, then to show the cost of erecting and tearing down the forms in the same way, the cost of all labor on the cubic-yard basis and also the materials and supplies of all kinds. Thus, the cubic-yard cost of every item can be found.

In Figure 6 is shown an office cost form on which to keep the plant and general expense items so as to make a daily unit charge against each kind of work done. It must be understood that the other cost-keeping forms are for recording field costs and that after these are turned into the office each day these general expenses must be added to the field cost.

For this purpose there must be analysis sheets. The field costs are analyzed each day on these sheets, and the office costs are then added. In this way the costs are made complete, yet to give them their greatest value their totals should be entered in a monthly cost book, so that each day's costs can be compared with those previously recorded as well as with the estimated cost compiled when bidding on the job.

Thus we have been able to see the real value of cost records and how cost can be kept incorrectly, and have followed the outline of a real cost-keeping system planned so that anyone interested in the subject can devise the necessary forms for a modern system.

Costs of Drag-Line Operation

Operating Costs on Canal and Drainage Ditch Work

IN the United States Reclamation on the Klamath Project in Oregon there has been an interesting opportunity to note the cost of operating drag-line excavators on canal and drainage ditch work. A Monighan walking drag-line, a Bucyrus 30-B drag-line and a Class 14 Bucyrus drag-line are now being operated. The first two are digging canals, and the latter is used for cleaning out drains which have filled up. The canals which the Monighan is building average 25 feet in width, with a 3-foot cut and a 7-foot bank. The Class 14 is

working on canals 25 feet wide, and the cut averages 10 feet. Material is mostly sand, with some hard chalk.

Up to May 1, 1921, the total quantity excavated by drag-lines amounted to 1,350,000 cubic yards, the average cost being 12 cents per cubic yard, including all field costs, such as moving, establishing camps, supplies, etc. During the month of June, 1921, the Bucyrus 30-B cleaned 13,072 linear feet of drains. The total amount of material excavated was 12,129 cubic yards, working 51 1/4 8-hour shifts.

Why We Buy and Sell on Promptness of Delivery

By Louis J. Horowitz
President, Thompson-Starrett Company

"We have found that it pays to devote more attention to making certain of always delivering on time than to any other point, because delivery is the hardest of all promises to fulfil."

WHETHER I am selling or being sold to, two features stand out above all others as selling points: the first is time of delivery, and the second is quality in the broad sense. Price is naturally important, but there is no way of finding out what a price is without knowing the quality, and especially the time of delivery.

Time of delivery we all know about. It seems ridiculous to talk about it at all; it would be, if time were not the most important and also the most neglected of all business elements. I say this advisedly. I know that I can go out anywhere and buy this or that at a price less than at the moment I happen to be paying for the article. I can buy it; that is, I can contract to buy it. But I shall be lucky indeed if, along about the time of delivery, I do not get a matter-of-fact, casual letter (showing that such letters are not unusual with the company) in which is set forth that, owing to having been held up by supply men, or by labor or by transportation, or by something, the materials will be somewhat delayed. There may be a formal apology, but more than likely the whole letter will display no more emotion than if the writer were acknowledging an application for a position.

Why Excuse Too Often Takes the Place of Performance

The sales force may be good business getters, the factory may be good producers, but once an order is booked it seems to be taken as inevitable that its fulfilment may be delayed. The arrangements may go so far as to prevent delays within the factory, but rarely do they go farther. It is considered that if the delay occurs on the outside, through the failure of some intermediate handler or through transportation, the excuse is sufficient to make further effort unnecessary.

It has been our experience, on the contrary, that a failure to deliver on the day set is as serious as failure to meet a note when due. A bank will take excuses and extend the time of payment of a note, but the borrower's credit will be none the better for it. And if he has a habit of failing to meet his notes when due, shortly he will have no credit. I have in mind a dozen respectable, conscientious companies from which we simply cannot buy. They make good stuff, their prices are fair, and we should like to do business with them. But we know from experience that never will they deliver on

the day fixed and that their excuses will be impregnable.

We have made delivery on time our first selling point. It is an easy selling point to make,—no end of pretty phrases can be grouped about it,—but it is the hardest of all sales representations continuously to maintain. In our business, dealing mostly with large units, it means thousands of dollars a day loss to the owners to have delivery after the day set. In an office building, apartment or hotel, the leases are made in advance.

For instance, many of the office buildings erected in New York in the last several years depended for their value as investments over a long period upon getting their tenants in at the high prevailing rates. It was possible, in spite of cost of construction, to gain such rentals as would permit the amortization of the excessive costs, as well as to show a fair profit—if only the building were erected quickly enough. The interest on the investment represented by the Equitable Building, for example, is more than two million dollars a year. We put up that building in twelve months after the foundations were completed—had it finished before the delivery date. Ten years ago a building of that size could not have been erected under three years. I doubt if under those circumstances it could ever have been made profitable, for it would have started under a load of accumulated interest and lost income. Speed of construction has been one of the less recognized factors in making the big, privately owned building possible.

Our own stakes are thus higher than the average. It means more in dollars for us to finish a building on or ahead of time than it does for a maker of, say, a small order of goods to get them through on schedule. But does it mean any more in a comparative way?

The making good of sales promises as to delivery is not easy. Much of our time is given over to the prevention of accidents.

Here is our procedure. It is in part peculiar to our business, but in theory it is of general application, the details alone changing. Our business, let me say, is usually conducted on a basis of the owner paying the amount of the bills plus a fixed fee, we guaranteeing that the price will not go above a certain fixed figure. He calculates his income and outgo on the basis of this outside figure. If he can see a profit at that largest possible cost, he will be more than safe by any cut on our part below it. As part

of the calculation, we must fix a time for completion. This time of completion may be our whole sales argument. There are a number of good builders, and the competition is exceedingly keen.

The Point That May Be Our Whole Sales Argument

We have found that it pays to devote more attention to making certain of always delivering on time than to any other point, because, as I have said, delivery is the hardest of all promises to fulfil. We are in the same position as every other business—that is, we are only a link in the chain, and if those ahead of us do not make their promises good, then we cannot make our promises good. We have men who always know the capacity of each concern in the country with which we might possibly do business. These men know what this or that company can make and how long it will take them to make it. The easy method of ascertaining what any manufacturer is capable of is to ask him, but, unfortunately, in the face of a large order one cannot depend upon all manufacturers' estimates of their ability.

Take a manufacturer of doors. We wanted a number of finely made doors. We had to have them within a certain time. We knew this manufacturer could make exactly the quality of door that we wanted. We were not so certain of his capacity. He thought otherwise. He said he could get through the whole order within the time specified. Then we investigated. We found—I am using arbitrary figures—that if he did nothing else and worked 24 hours a day he could turn out 25 doors each day. We also calculated how long it would be before he could get the lumber. There was no way, as far as we could discover, that he could increase his output without adding to his space, buying additional machinery, and taking on untrained men. There was no way that he could get lumber before a given date. It was a simple mathematical calculation to show that 25 doors a day would not fill the order on time, without making allowance for breakdowns or a single accident of any kind. In the ordinary circumstance, and without investigation of capacity and especially of lumber supply, we should have given him the order, and when it came to the time for the delivering under our contract we should have had to tell our employer that our work was all done, but the door man had disappointed us. We should have had a perfectly good excuse, but we hold that the best excuse forms the worst reason. Really, the delay would have been ours, not the door man's, for it was our duty to see that the orders we gave could in the ordinary course of events be carried out. So we divided that order.

Now that door maker was a perfectly sincere man, but he forgot that miracles do not happen, that things do not carry themselves out—they must be carried out.

We go through this same procedure with every item entering into a contract. We find out what can be done; we find out whether by extra and more intelligent effort the time can be shortened. Our engineers concern themselves with shortening ordinary times of operations as well as with testing the quality of goods. With these facts in hand, we are ready to say what we can do and ready to know positively what we can do. We are ready to make our stipulations as to time, and ready to meet or to reject a stipulation as to time.

Suppose we get the order. Then we make up a calendar for the job. We have a date when we can start and a date of delivery. We work out when each part of the building ought to be finished—when the foundations ought to be dug or the ironwork, the masonry, and so on, ought to be commenced and completed. That is a simple enough schedule; we supplement this, however, by a more detailed schedule on the necessary progress of the work outside of our immediate control—as the making of the plumbing fixtures, the hardware—every detail. This calendar is the whole instruction book for the job. I have a folder on my desk containing the calendar for each job that we are doing and the exact condition of each item.

Once a week we hold a meeting of department heads. We do not discuss any item of any job that is on time. We discuss only those that are back, and that meeting does not waste an instant on excuses; it devises ways and means to bring things up to date. When we had the national car shortage we were, with other companies, held back by the inability of the railroads to transport materials. We sent men out to get the materials on cars at all costs and to stay with those cars until they reached their destinations. In one case, where there seemed to be no way of getting cement to a certain job, we bought 90 railroad cars and rushed them through.

That was an emergency. We find, however, that it is more to the point to forestall than to meet emergencies, so we keep a force of inspectors out reporting to us the progress of everything that is being made for us. We find that it does not pay to see what can be done after a delivery date. We find that it pays far better to know at every point and long ahead just how things are going.

Perhaps it would not pay for a company treating with smaller units to go to the trouble and expense that we do in making certain of delivery. But our own troubles are never with the big things—if the little things are done, the big ones take care of themselves.

We get orders because of delivery, and we give them because of delivery. And we find that every dollar we lay out to insure promptness brings more than a dollar back.

ACKNOWLEDGMENT.—Reprinted in abstract by permission from *System*, February, 1922.

Don't Gamble—Compute

The contractor who bids on a contract previously advertised and who deliberately sits down and figures a set of prices designed to beat the previous low bidder, without honestly satisfying himself by analysis and calculation that he can afford to do the work at the prices bid, is a criminal gambler, a menace to himself and the public as well. The sooner he is eliminated, the better for the industry.—Henry H. Wilson.

A New Concrete Road Striking-off, Tamping and Finishing Machine

AMACHINE for striking-off, tamping and finishing concrete roads and base courses has been recently placed on the market under the name of the Dunn Mile-A-Week Road Builder by the Dunn Road Machinery Company, Conneaut, Ohio. In a commercial way this machine made its appearance at the Good Roads Show at Chicago in January. The first one, however, was built in 1915, and patents were granted in 1918. Later, a few more were

exactly where specified and with no additional labor cost and a decided saving in time.

In operation, the machine strikes off the concrete in two levels, allowing about a 2-inch layer to pass under the auxiliary strike-off. This 2-inch layer is operated upon by the clearing tamper, which has an adjustable vertical movement and comparatively slow speed. Its action is such that all large pieces of aggregate are pressed slightly below the finished surface,



A DUNN CONCRETE ROAD FINISHER AT WORK

On this road, records of 902, and later 1,005, feet of 16-foot roadway 6 inches thick at edge and 8 inches at center have been made for one day's work

constructed for contractors, and practically all of them have been in continuous operation since starting.

The principle of operation of the new machine is claimed to have been proved correct, and it has stood up under a great deal of hard usage which it has been given during its testing period. Reports have shown that these machines have cost almost nothing for repairs and at the same time have damaged none of the road forms over which they have been running.

The machine is arranged for tamping and belt finishing concrete roads, but includes in its construction four space blocks which can be removed in a few minutes, and when this is done and the finishing belt removed—all told, about a half-hour's work—the machine is ready for working on base courses for any other type of surface.

The "Sub Strike-off" is used when working on two-course concrete pavements. By means of a self-locking lever it is dropped in front of the machine and strikes off the first course any required distance below the top of the forms, making it possible to locate the reinforcement

and the entire mass is compacted without changing the condition of the mixture. The main or final strike-off follows the clearing tamper and, having to contend with only fine material, cuts clean and smooth with no tearing up of the surface.

The next successive operations are by the spader, a $\frac{3}{8}$ -inch blade suspended from the front end of five rocker arms, and the tamper, a 4-inch channel with flanges turned up, hung from the rear end of the same rockers. They both have a vertical movement and are driven by eccentric cams. Both are adjustable as to depth of stroke and contour.

The finishing belt has a 5-inch transverse stroke and can be lifted clear of the road, started and stopped by an operator who rides on a platform located in the middle and on the front side of the tamper. The position of the operator is such that he has an unobstructed view of the entire road over which he is working, and all controlled levers are grouped within easy reach. Positive forward motion is obtained by means of two cables, anchored to stakes ahead of the machine and wound up on

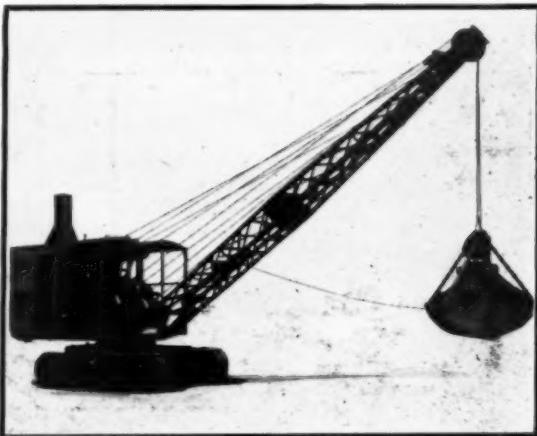
two independently controlled drums, giving a powerful drive arrangement not affected by the amount of concrete accumulated ahead of the machine. In reverse, not being in action and

having no load other than its weight, the tamper is driven by traction on all wheels. Forward speed is 3 feet per minute, and reverse 20 feet per minute.

A New Model Auto Crane

A NEW "Model 4" auto crane has just been brought out by the Byers Machine Company, 480 Sycamore Street, Ravenna, Ohio. This machine has a car body 17 feet 2 inches by 6 feet 6 inches, with a total width to the outside of the wheels of 9 feet 7 inches. The caterpillar traction has a total width from outside to outside of 10 feet 7 inches.

For use with this crane, any 1-yard clam-shell bucket weighing less than 2,700 pounds for car unloading, or $\frac{3}{4}$ -yard for excavating, is recommended. The maximum operating radius of the machine is 20 feet. Additional height can be secured by a longer boom when used as a derrick for lighter loads, but the 20-foot radius is the maxi-



NEW MODEL "4" CRANE EQUIPPED WITH CLAM-SHELL



FRONT VIEW OF NEW CRANE, SHOWING TREAD AND BOOM SETTING

mum. The capacity of the crane is 10,000 pounds at 10 feet on double, 8,000 pounds at 15 feet, 6,500 pounds at 20 feet, and 5,500 pounds bucket and load at 20 feet on a single line. The boom is 30 feet for bucket work, and in special cases can be used up to 40 feet for derrick work.

For moving the crane about, making it a readily portable unit, it can travel under its own power either forward or reverse at the rate of 100 feet per minute on a hard, level surface. Steam, gasoline or electric drive is used on the crane.

A fair price is the only basis for satisfactory work, especially in road building.

—*Highway News Digest.*

How Contractors Are Lowering Ditching Costs

THAT this is the age of machinery is nowhere better illustrated than in the field of trench excavating. Machines are today digging trenches for drainage, for pipe lines, and numerous other purposes under conditions which would make the work prohibitive if it had to be done with hand labor. Time and cost are such important factors—and becoming more so every day—that good, dependable machinery must be used in order to meet the competition.

So to-day progressive contractors are using machinery as much as possible. They are digging trenches at lower cost than the cheapest hand labor could possibly dig them. And they figure more closely in price because there is less

"All the ditch," says R. S. Lord, Vice-President of the Hope Engineering & Supply Company, "was 42 inches deep and 20 inches wide. The best record of work done by one machine in 24 hours was 7,800 feet, but in many cases over a mile per day per machine was cut day after day."

This is a splendid example of what can be accomplished by dependable machinery when coupled with good organization.

Digging in Hard Soapstone Clay

The saving in time accomplished by machinery always appeals to the wide-awake contractor. It allows him to increase his volume of



QUICKLY RUNNING A DITCH THROUGH A CITY STREET

uncertainty about machinery than about hand labor. Furthermore, they lower costs by making better time, working day and night, if necessary, to get the job done. They push the job right along under adverse weather conditions—rain, cold and heat—in fact, under conditions where they wouldn't expect men to work.

90-Mile Line Laid in 65 Days

An interesting example of what can be accomplished by machinery is a 90-mile pipe line which was laid in only 65 working days.

This was a \$1,000,000 job. The pipe line extended from Casper, Wyo., to the Ferris, Mahoney and Lost Soldier fields and was handled by the Hope Engineering and Supply Company, Mt. Vernon, Ohio. It was a part of the contract that the work be done within a certain time limit. The Hope people not only did the job on time, but they beat it by 18 days. They dug the trench entirely with Buckeye traction ditchers, except for 10 miles, mostly in Sand Creek, where hand crews were employed.

work tremendously and, consequently, even though he decides to operate on a smaller margin of profit, his gross profit for the year is larger because of greater volume.

When one stops to consider how long it would take to get out 850 cubic yards of hard soapstone clay with hand labor, and then compares this with 6½ hours for machinery, it is easy to see that there is a big saving in time. C. R. Nichols of Wichita Falls, Texas, made this record with his Buckeye.

Another Nichols job was the excavating for sanitary sewers in that city—a system comprising 150,000 feet. Mr. Nichols averaged 850 lineal feet in 8 hours. The trench averaged 33 inches wide by 13½ feet deep.

\$10,000 Worth of Work—Repairs Cost Less Than \$175

If there is one thing more than any other which contractors appreciate in ditching machinery, it is dependability. They want a machine that works steadily and efficiently. If a

machine is continually laid up for repairs, profits are soon eaten up.

In this connection the experience of Clem Ratcliff of Kingman, Ind., is interesting. He has operated a traction ditcher—Buckeye 4-A—for about two years, and the cost of repairs has been only \$175. This is very significant when one considers that the two years covered about \$10,000 worth of work. Mr. Ratcliff's best day's work consisted of 127 rods of 5½-feet trench for 18- and 20-inch tile.

The low repair expense and reasonable operating cost of \$20 a day or less bears tribute to the dependability of this machine. Furthermore, Mr. Ratcliff believes his ditcher is practically as good as the day he bought it.

Scores of contractors have a complete equip-

ment of machinery, so as to handle the job from start to finish. A concrete breaker, preceding the ditcher, breaks up the pavement. It can break up about 16 feet a minute. Then comes the ditcher, which hustles out the dirt—never "lays off," no matter what the weather conditions are or what attractions may exist in the neighborhood. Then, when the tile are laid, along comes a backfiller and hustles the dirt back into place, completing the job. One can readily see what an efficient, profit-producing outfit this makes.

Good, dependable machinery always eliminates a great deal of uncertainty as to time and cost. It gets the work done more quickly. It means less trouble and worry, and lower costs, as well as bigger profits.

A New Concrete Mixer of 3-Cubic-Feet Capacity

A NEW concrete mixer having a capacity of 3 cubic feet of wet concrete per batch has been brought out by the Archer Iron Works, Western Avenue and 34th Place, Chicago, Ill. This mixer is built along the same general lines as the Archer No. 1 special and one-bag mixers, embodying quick loading, portability and end discharge.

This new mixer can be handled with a small crew, it is simple in construction, readily portable, claimed to be low in operating cost and up-keep, and is easily adaptable to the varying requirements of the small contractor. Although conservatively rated at 3 cubic feet of wet concrete per batch, the drum has sufficient capacity to take care of a half-bag mix or almost any proportion of material.

This mixer is equipped with a 1½-horse-power Fairbanks-Morse engine and Bosch magneto and is also fitted with clutch and chilled drum rollers. The price of the mixer is \$275 f.o.b. Chicago, including the loading platform. In operation, materials are wheeled onto the



A READILY PORTABLE ONE-MAN MIXER

low loading platform and dumped directly into the hopper. In many cases the mixer can be backed up to the forms and the wet concrete spouted directly into place without intermediate handling, this reducing labor charges as well as increasing output.

Overloading Is Detrimental to the Road Surface

While making an investigation of highway traffic in Connecticut during the summer of 1921, the Bureau of Public Roads and the State Highway Department of Connecticut found that every third truck on the Hartford-Springfield Road and the Boston Post Road was loaded beyond the capacity of the truck and tires. This is detrimental to the road surface. Overloading occurred on all types of trucks, but was most common on those of the 3- to 5-ton capacity. One 3-ton truck was found to have 63 per cent overload.

—*Highway News Digest,*

Air-Dump Cars in Emergency Work

Standard Cars Handle Emergency Work as Well as Regular Service

EMERGENCIES in railroad operation are the points of quickened interest to everybody. Emergencies throw the spotlight on the routine operation of the line and quickly reveal the efficiency of its operating methods. An interesting story of the use of Kilbourne & Jacobs all-steel automatic air-dump cars down in the mountains, tells how a slide came down and completely covered the road-bed for some distance. Keeping the main line clear in regions such as this often involves a problem of slide fighting which means a diversity of difficulties. There are slides that are mud and slides that are rock, slides that are covered and interwoven with logs, and each of them often carries tons and tons of wreckage down on the right of way. Some slides are so slow they can be removed as fast as they advance, and some descend like a flash and bury the line to such a depth that its position can be determined only with transits.

One of the latter kind brought the emergency facilities of one of the big railway systems into hasty action a while ago and provided an interesting and highly satisfactory test of both methods and equipment.

In this slide were approximately 75,000 cubic yards of mud and rock, crowned with what had been standing timber. Starting from a point half-way up the mountain, it swept down and buried the main line to a depth of about 25 feet. Its fan-shaped base covered 350 feet of track and set 20,000 yards down for removal before the line could be even opened. Seventy-five per cent of this 20,000 yards was rock and logs. To make a finished job of it, a spring in the mountain side found its channel diverted to the path of the slide, pouring its accumulation into the mass and making the working base a mud pond 3 to 4 feet deep.



DUMPING THE SLIDE DEBRIS

Across the river on the opposite mountain a mile or so away there happened to be at the time another slide of large proportions, although slow-moving. A construction outfit belonging to Pitts & Morris was at work cutting it back. This outfit consisted of six K & J all-steel automatic air-dump cars, a Marion No. 60 steam shovel and a Jordan spreader. Farther up the line, working on bridge construction, was N. K. Sneed's outfit, consisting of nine K & J all-steel automatic air-dump cars of 16-cubic-yard capacity, as well as another 70-ton 2½-yard shovel. Both outfits were rushed to the scene. The Pitts & Morris unit came up on the east side of the blockade, and the N. K. Sneed unit on the west side opposite.

A preliminary cut was made through the mass, the two shovels advancing to meet at the center, casting the material. This provided a passage parallel with the site of the road-bed to permit the introduction of cars. The shovels were then moved back and the work of actually clearing the road-bed was begun. This work proceeded with highly satisfactory speed, considering that a major part of the burden was logs and large rocks. Logs had to be sawed, rocks chained, and the shovels moved by men working in several feet of mud and water. Progress was made at the rate of about 2,300 yards per day with a half-mile haul. In eleven days the right of way was cleared and traffic opened.

Meanwhile the outfit of Carpenter, Major Brothers, was brought to the slow-moving slide abandoned by Pitts & Morris, putting five K & J all-steel automatic dump cars and a shovel at work here. The job of cutting back this slide was not allowed to pause longer than the time necessary to bring up the new outfit. The work done by the dump cars in these several outfits was not more productive in this emergency than is their daily work.



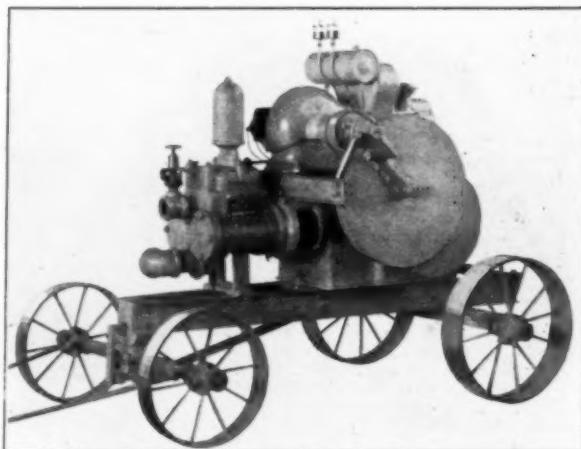
ALL-STEEL AUTOMATIC AIR-DUMP CAR OUTFIT OF CARPENTER, MAJOR BROTHERS & CO., WORKING AT FACE OF SLOW-MOVING SLIDE

Pumping Equipment for Highway Contractors

WITH the very extensive highway program in prospect, the demand for builders during the next few years will of necessity draw into the work many who are more or less inexperienced in this form of contract and are without the equipment to make the venture a profitable one. The type of roadway, the lay of the country, the geographical location, as well as many other details, must be considered carefully in order to obtain the road-building equipment most suitable for the job at hand.

A small, but important, item of such equipment is the pump upon which depends the necessary water-supply. The pump should be selected carefully with a full knowledge of the requirements in regard to capacity, pressure, condition of water and source of supply. The illustration herewith shows one of the many varieties of pumping units built by the Chalmers Pump & Manufacturing Company, Lima, Ohio.

This Canton-Hughes portable pressure pump is of high-grade construction, designed to meet the severe conditions of contracting work and of installations permitting but slight attendance. The pump is of the duplex center crank type, having two double-acting pistons, working in brass-lined water cylinders. The crank-shaft, connecting rods and pinions are all of steel, and the piston-rods, valve-seats, stems and springs of bronze. The cross-heads work in bored guides with adjustable shoes to take up wear.



A CONTRACTORS' PORTABLE PRESSURE PUMP

A relief valve is furnished to prevent damage to the pump from excessive pressure when a line is shut off.

The engine is a 6-horse-power unit of the horizontal, two-cylinder, copper-cooled type, with fly-wheel and running-gear totally enclosed. It uses either gasoline or kerosene for fuel, with gravity feed. It has variable speed control and is fitted with a gear-driven magneto, not requiring batteries. The engine is started by a strap, eliminating the danger of cranking; furthermore, no warming up is necessary. A friction clutch is provided so that the engine can be started easily without load. The engine is fitted also with a pulley permitting the use of its power entirely for any other purpose, such as driving a portable saw, a concrete mixer, or a diaphragm pump.

The Growth of Modern Highway Traffic

Engineers Must Truly Build for the Future

THE necessity for the development of hard-surfaced pavements is due to the growth of modern traffic, and in a few years many roads which now carry only local traffic will be carrying a large percentage of through or interstate traffic.

Some idea of the future traffic on trunk line highways is given in the report on two traffic censuses taken by the Bureau of Public Roads in cooperation with the State Highway Department of Connecticut, during the summer of 1921. The roads selected were part of a fairly

complete system of highways. The first census showed an average of 2,907 passenger cars and 281 trucks passing the recording station per day, and the second, 3,832 cars and 511 trucks. Forty-seven per cent of the cars, or nearly half, came from without the state. Drivers were questioned as to length of travel for the day, and results showed average figures of 70 miles and 52.4 miles for the two censuses. The average haul for truck traffic was 47½ miles, some of them hauling a distance of 250 miles.

—Highway News Digest.

The New Type of Crane Excavator

A NEW design of crane excavator which embodies some unique time- and labor-saving features has been put on the market by the Koehring Company, of Milwaukee, Wis., manufacturers of concrete mixers.

This machine is mounted on a multi-plane traction with a full circle swing turntable; the power is furnished by a 4-cylinder, automatic gasoline engine of the slow-speed, heavy-duty type. The engine is provided with a fan cooling system and an air-distributing type self-starter. The operation of the machine is easily interchangeable from drag-line bucket to clam-shell bucket or electric magnet.

Two sizes of this crane-excavator are now ready for the market. Size No. 2 has a lifting capacity of 24,000 pounds at a radius of 12 feet, a 70-h.p. automatic gasoline engine, and a standard boom 35 feet long. No. 3 is a crane with



CRANE WITH CLAM-SHELL

The base plate, turntable casting, side frames and all gearings are made of high carbon annealed cast steel, and all gears above the base plate have cut teeth. The shafting arrangement is such that almost any shaft can be taken out without disturbing any other, should occasion make it necessary. For ease of operation, the levers are all banked at the forward end of the right-hand side platform.

A feature of the Koehring line of crane excavators of particular interest to contractors is the arrangement whereby, when the operator desires to change from clam-shell operation in handling of materials to drag-line excavator work, all that is necessary is to unhook the rope sockets of the clam-shell cables from their respective drums, coil the cables up with the clam-shell bucket and reeve in and hook fast the cables with the sockets for the drag-line bucket, then by the speed-change device the line speed of operation is reduced from 240 feet per minute to 120 feet per minute, and the pulling power on each line is increased from 10,000 to 20,000 pounds. Through this arrangement no change is necessary in the machinery, and the change from one type of bucket to the other can be made in a very short time.

Another feature of interest to the contractor handling materials is the fact that a double drum with two cables is used for the boom hoist. The cables lead out over sheaves on each side of the boom, and after passing over the

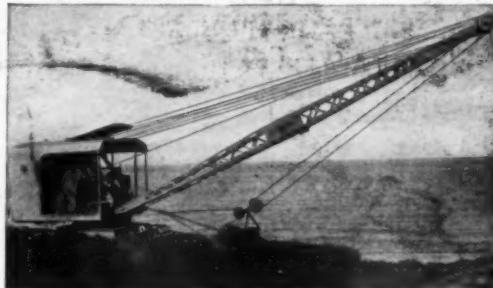


HARD AT WORK IN THE DISTANCE

lifting capacity of 40,000 pounds at 12-foot radius, a 100-h.p. automatic gasoline engine, and a standard boom 45 feet long. The general construction of the two sizes is identical.

The multiplanes which the Koehring Company uses on its new line of cranes have the shoes faced on the bottom with renewable high carbon steel plates. The shoes are connected to each other by the familiar type of hinge construction, giving bearing on the hinge-pins the full width of the shoe; they are smooth on top, there are no projections to catch on brush or pockets to pack full of mud.

In traveling, the crane has three speeds both forward and reverse and can negotiate grades as steep as 30 degrees. In steering, the crane excavator makes use of a speed-change differential, so that one side goes faster than the other when corners have to be turned. The speed change is effected through lever connection to the lever stand on the operator's platform, so that the operator has full control of the propelling and steering of the crane without having to leave his position at the lever stand. All movements or functions of the crane are controlled independently of each other by a new type of outside band friction.



CRANE OPERATING AS DRAG-LINE

requisite number of sheaves to give the right number of parts of line, meet in an equalizer. Through this arrangement there is no side twist or excessive pull on one side of the boom due

to friction loss in journals and compounding of bending stress in the cables, as might be the case when only one boom hoist cable is provided.

Motor Trucks Help Build New Niagara Power Aqueduct

THE \$8,500,000 power-extension plant being developed by the Niagara Falls Power Company, Niagara Falls, N. Y., includes the excavation and hauling of nearly 750,000 cubic yards of material blasted from solid rock. The Read-Coddington Engineering Company, contractor for this work, is using motor trucks for handling the excavated material. The project calls for the tunneling of a 4,300-foot underground aqueduct to convey water from the Niagara River above the falls to the company's power-house. A fan-shaped inlet sloping to a depth of 70 feet and a rectangular outlet or forebay 80 feet deep are at either end of the tunnel. Trisecting the tunnel are two shafts, 10 feet wide, 30 feet long, and 145 feet deep. These units, that is, the inlet, the outlet, and the tunnel, are being blasted out of solid limestone. The flow of water will be used in generating about 200,000 horse-power in addition to the 265,000 being developed at the present plant of the Niagara Falls Power Company.

The Read-Coddington Company is using 20

5-ton dual-valve Pierce-Arrow trucks equipped with 4-yard dump bodies for this work. The horizontal type of power hoist is used; the mounting of this type beneath the body gives more load room, as the body can be brought closer to the cab. Steel bodies are being used on the truck and four 35-pound steel rails are used to reinforce the bed of each body against the shock of loading the rock. The steel rails also facilitate dumping, as the load slides off easily.

Excavation was started April 25, 1921, at the outlet, where 60,000 solid yards, equivalent to double that figure in terms of loose yards, are being removed. At the end of six months about 45,000 yards had been excavated. In the meantime the two tunnel shafts and the inlet excavation were under way. An average of 10 trucks serve the shovel and cranes at the outlet, the remainder of the fleet being used at the other point.

It was soon found that at the speed with which the trucks operated, the steam shovel



PLACING THE HEAVY LOAD OF ROCK WELL FORWARD OBIATATED THE NEED OF TAIL-GATES

The steel rails for bracing the truck body against the shock of loads are seen clearly. The truck on the incline has just shifted to "second" preparatory to taking the 10 per cent grade ahead of it

could serve as many as 12 trucks, although at times only 10 were used, with a haul of 2 miles. Each truck makes from 11 to 13 trips a day, so that an average of 135 to 140 loads is removed daily. About 2 solid yards of rock is loaded each time.

Operation of the trucks soon revealed several practical features which speeded up the work. For instance, the tail-gates were dispensed with, for it was found that a full load could be carried by piling it at the forward end of the body; thus no time is lost in fastening or unfastening the tail-gate locks. Moreover, the steam shovel operator works with greater freedom, for there is no danger of damaging the tail-gates with the shovel.

Another device that has resulted in economy of time and fuel is the method used in constructing the incline. To climb out of the pit the trucks ascend a short ramp which has a grade of 20 per cent. This is done, of course, in low gear. For a short distance the climb is one of 12 per cent, which levels out for 30 feet into a grade of only a few per cent. This gives the driver ample opportunity to shift from low to second gear preparatory to the final 250-foot climb of 10 per cent. In other words, a "gear shift level" enables the trucks to gain headway sufficient to make a faster ascent with a smaller expenditure of fuel. Thus, in spite of gear work on the incline and over the rough dumping ground, a fleet average of 4.5 miles per gallon of gasoline is maintained.

The Trucks Stand Hard Usage

Although every effort is made to lighten the abuse to which the trucks are subjected, the contractors have found it impossible to avoid a certain amount of it. For instance, in loading a jagged boulder so big that it weighs well over 5 tons, the steam shovel will drop it as gently as possible on the rear of the truck, and then, in order to place the load well forward on the

truck, the shovel will "bunt" it ahead. This operation shakes the truck as if it were a boy's cart.

The surface of the pit is kept as smooth as possible, but it is frequently strewn with rock and débris. It is not unusual for a truck to back over a rock the size of a barrel, dropping from it with a severe jar, or for a loaded truck to bounce over a heap of rough stones. Breakage is to be expected, but at the end of 10,000 miles of operation the contractors were surprised to find that the trucks had escaped the repair shop more than 90 per cent of the time. In fact, most of what little repair work was done was necessitated through accidental collisions. To keep the trucks in adjustment and to facilitate emergency repairs, a chief mechanic and an assistant are employed. Close attention is given to lubrication; it is the sole duty of one man to grease and oil the chassis systematically.

Difficulties encountered by the trucks which are working on the inlet excavation equal those which have made the outlet so severe as a testing ground. At the inlet the work is being done behind a cofferdam which locks out the river, and about 50,000 solid yards of limestone, equivalent to 100,000 cubic yards of loose material, is being removed.

A group of four or five trucks is employed on the shafts which will pierce the tunnel. These trucks are worked double shift most of the time. From the two shafts about 3,000 cubic yards of solid material is being removed. The material is hoisted in a bucket which drops a full load into the truck.

All of the material from the tunnel likewise will be hoisted through the shafts, with the exception of that which is being blasted from the tunnel intake and outlet. The intake and outlet are bell-shaped, narrowing from a diameter of 50 feet to 36 feet, excavation measurements. The actual diameter of the tunnel when lined will be 32 feet, and about 350,000 loose yards will be removed.

Literally Paved with Silver and Gold

Motorists passing along the Washington State Highway between Valley and Chewelah, ten miles north of Seattle, like the charioteers of the ancient Persians, Syrians and Egyptians, are literally driving now over a silver highway, which, were it run through the mill, would net thousands of dollars worth of silver bars, according to authentic reports. In building this highway the contractors opened a quarry of quartzite, which was crushed and spread over the road as a macadam surface. Investigators took samples of the bed to an assayer and learned that perfectly good silver ore, running two dollars or better to the ton, with traces of gold, had been used on the road. The job called for 7,500 tons of the ore. At this figure the road-bed alone is worth \$15,000 in silver or gold.

Up-to-Date Steam Shovels

Types Fitted for Great Variety of Work

IN the old Panama construction days, technical periodicals ran page after page of stories on the mammoth shovels which were making that great ditch across the Isthmus. To-day there are fully as many large shovels operating, but they are scattered throughout the country. For every one of these huge dirt movers, contractors are using dozens of $\frac{1}{2}$ - and $\frac{3}{4}$ -yard shovels for every-day work in cities and towns and on the country highways.

Our first illustration shows a $\frac{1}{2}$ -yard type OO Thew steam shovel, handling some rock work in West Virginia. The size of rock handled shows that the $\frac{1}{2}$ -yard shovel is a



DIGGING A ROADWAY THROUGH ROCK



BREAKING, DIGGING UP AND LOADING 6-INCH CONCRETE PAVEMENT

sturdy proposition. The owner has expressed himself as very well satisfied with the way this shovel is operating.

The Ryan Company, Chicago, Ill., owns the type O $\frac{3}{4}$ -yard steam shovel shown in the second illustration as breaking, digging up and loading 6-inch concrete on South Wabash Avenue, Chicago, Ill. On this job the shovel averaged over 400 feet a day. The total amount of work extended over a distance of $2\frac{1}{2}$ miles. No apparatus or machines of any kind were used to help the shovel in breaking up the 6-inch concrete.

The third illustration, showing a shovel owned by Herman Hohensee,

Milwaukee, Wis., handled over 100,000 cubic yards of excavation for the new Milwaukee reservoir. The last illustration takes us back to Panama, where a type O, $\frac{3}{4}$ -yard Thew steam shovel on a continuous tread is shown at work handling loose material. Between April and October, 1921, it was worked in two shifts digging and loading a little over 225,000 cubic yards of rock and clay.

With municipal construction booming, contractors will do well to seriously consider their excavating equipment, being sure that they have the proper machine for each type of job, or a machine adaptable to different kinds of work, such as sewers, trenches, reservoirs, etc.



EXCAVATING FOR A RESERVOIR

ASSOCIATED GENERAL CONTRACTORS NEWS NOTES AND COMMENTS

A Council Which Will Raise the Plane of the Construction Industry

PRELIMINARY arrangements were completed at Washington, D. C., May 3 for the organization of the American Construction Council, when Secretary of Commerce Hoover agreed to accept the chairmanship of the organization meeting to be held in Pittsburgh, June 19. Franklin D. Roosevelt, of New York, formerly Assistant Secretary of the Navy, has consented to accept the presidency of the organization.

The purpose of the Council is to place the construction industry on a high plane of integrity and efficiency and to correlate the efforts toward betterment made by the existing organizations, through a conference association representative of the whole industry and dedicated to the improvement of the service which the construction industry renders to communities, states and nation.

All branches of the industry are represented in the new body and have been divided into the following groups, all with equal voting power: architects, engineers, general contractors, subcontractors, construction labor, material and equipment manufacturers, material and equipment dealers, financial bond and real estate interests, public utility construction departments, and the construction divisions of federal, state, and municipal governments.

So far as is known, this is the first time in the history of American industrial development that any industry has been represented by an organization in which all the elements have been brought together for the mutual interest of the industry and the public.

This action is the culmination of many efforts that have been made in recent years to solve the difficult problems thrown on the industry by reason of its size and complexity and the accumulation of construction due to the cessation of building activities during the war. The immediate inspiration for the movement has come from the interest displayed by Mr. Hoover in the industry and his belief in the importance of its revival for the awakening of business activity. In accepting the chairmanship, Mr. Hoover emphasized the need for an all-embracing organization such as the Council, and pointed out that if it had been in existence before the present depression, it would have been invaluable in furnishing to the public unbiased facts pertaining to the different phases of construction, thus probably winning for the industry the confidence of the public.

The organizers of the Council are planning to take up a number of important lines of work, among them the following: a code of ethics for the industry; development of a national building code; a research and statistical bureau;

lengthening of the construction season; elimination of waste; standardization and dimensional simplification; development of apprenticeship systems, and encouragement of local study and better understanding of building situations.

E. J. Russell, of the Executive Committee of the American Institute of Architects, has been chairman of the preliminary meetings, and the organizing work is in the hands of a committee consisting of the secretaries of the American Institute of Architects, the Federated American Engineering Societies, the Building Trades Department of the American Federation of Labor, the National Federation of Construction Industries, the National Lumber Manufacturers' Association, and the General Manager of the Associated General Contractors of America.

A. G. C. Biographies

Arthur Bent was cast by circumstances into the contracting game when he was just out of school, and, although it was not at all what he had dreamed of doing, he soon became obsessed with the idea that contracting offered an unusual opportunity for the infusion of ideals. And through thirty-five continuous years at it, he constantly hoped for the day when the great construction industry would come into its own, by securing from the public just the sort of recognition that the A. G. C. slogan is getting. He did not believe that such a splendid business, calling for so many resources, and so much experience and character, could forever lie under the stigma that attached to the name in his earlier years. It seemed a game which would inevitably challenge the interest and enthusiasm of great men. The vision of the day when a man could rightfully be proud of the fact that he was a contractor and reach an honorable position in his world because of it, rather than in spite of it, has always been before him, and now that day has come. The Bent Brothers, Arthur and Stanley, came into their own some years ago, when they foresaw the need of the West and specialized in the construction of concrete pipe, plain and reinforced, for hydroelectric and irrigation projects. Southern California alone now uses a million feet of concrete irrigation pipe a year. They built the 135-foot Lake Hodges Dam, the highest multiple-arch dam built to date; the Sweetwater Dam at San Diego; the Devil's Gate Dam at Pasadena, and many others, besides water-supply systems in a number of cities. As President of the Asso-

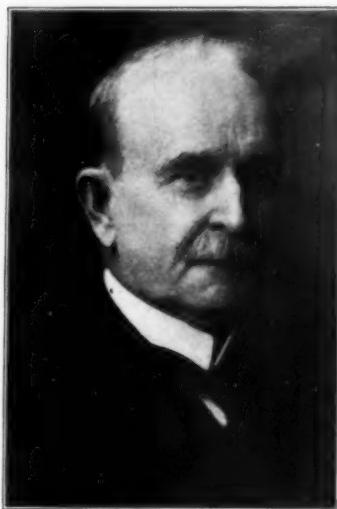


ARTHUR BENT

ciated General Contractors, Mr. Bent has already brought into the construction industry a vigorous note of idealism.

W. O. Winston is now located in business a long way from his birthplace, Hanover County, Va. He was born on February 6, 1853, and educated at private schools in Virginia. In 1872 he took up engineering in the service of the Chesapeake & Ohio Railroad. Two years later he left the South, going to Minnesota with the United States Government as a member of engineering parties in 1874 and 1875. He began the contracting business with his brothers, P. B. and F. G. Winston, in the winter of 1875-76.

under the firm name of Winston Brothers, at Minneapolis, Minn. Their business was incorporated in 1902 as Winston Brothers Company, and Winston-Dear Company. Mr. Winston served as Vice-President and President, and is now Chairman of the Board of Directors of Winston Brothers. Since the inception of the A. G. C., Mr. Winston has been an active supporter of the organization. In 1921 he was its President. He and D. A. Garber and Frederick L. Cranford, both of New York, created great interest in construction activity by reason of their transcontinental speaking trips in 1921.



W. O. WINSTON

Street Improvement in Chicago

If the paved streets in Chicago were built in a straight line, they would make a paved roadway 40 feet wide reaching from Lake Michigan to Seattle, Wash. This figure does not include Chicago's 78 miles of boulevard and 151 miles of park drive which connect the city's belt of parks. Chicago's alleys, if built in a straight line, would extend to New York and 700 miles to sea, and the city's paved alleys would make a roadway 16 feet wide from Chicago to Columbus, Ohio.

The area of the city is approximately 200 square miles. It is, roughly speaking, 14 miles wide and 25 miles long at its greatest length and breadth. Within its boundaries are 3,257 miles of streets, of which 2,143 miles are paved, and 1,721 miles of alleys, of which only 516 miles are paved, "streets first" having been the slogan

of the Board of Improvement for many years. The Board is building from 150 to 200 miles of improved streets within the limits of the city each year.

In 1921, Chicago spent \$2,000,000 for street paving, laying a total of 386,000 square yards of pavement without one cent of cost to abutting property owners. Of the paving laid last year, 1,37,608 square yards were of asphalt, 133,304 of macadam, 41,290 of brick, and 31,837 of granite block. The asphalt paving in Chicago totals 1,130 miles, or 49 per cent, that of macadam 470 miles, or 20 per cent, and of brick 366 miles, or 15 per cent. Other types of pavement are: Portland cement concrete, 150 miles, or 6 per cent; granite block, 118 miles, or 4.6 per cent; and creosoted wood blocks, 71 miles, or 3 per cent.

E VERY CATALOG SPECIALLY SELECTED

A FAST ROAD-FINISHING MACHINE

In its new literature, the Dunn Road Machinery Co., Conneaut, O., describes its road-finishing machine, which is claimed to be the fastest ever used in building concrete pavements.

CONCRETE WORK THAT LASTS

The Koehring Co., Milwaukee, Wis., has just issued a notable contribution to concrete engineering literature in the form of a booklet, "Built to Endure," which gives comparative examples of recent and modern construction embodying the elements of permanency. This booklet is illustrated with etchings in color and may be secured by interested executives, engineers and contractors free upon request.

COMPLETE LINE OF ASPHALT TOOLS

In the catalog and price list of Littleford Bros., 500 E. Pearl St., Cincinnati, O., contractors and street officials will find information regarding all kinds of asphalt paving tools, heaters and dryers.

ADJUSTABLE STEEL FORMS FOR CONCRETE FOUNDATIONS

In the catalog of the Reichert Metal Concrete Forms Co., 1200 Well St., Milwaukee, Wis., contractors will find an interesting discussion of the value of metal forms for concrete buildings and the savings which can be effected through the use of them.

A 4-CYLINDER MOTOR ROAD ROLLER

Contractors interested in road rollers should secure the catalog of the Acme Road Machinery Co., Frankfort, N. Y., describing its new 4-cylinder motor road roller with air pressure controlled scarifier.

GRADERS AND GRADER SCRAPPERS

In Catalog No. 21F, the Austin-Western Road Machinery Co., Chicago, Ill., tells the whole story of its fourteen models of A-W graders and grader scrapers.

SELF-LOADING FOUR-WHEEL SCRAPPERS

The catalog of the Baker Manufacturing Co., 585 Stanford Ave., Springfield, Ill., describes its line of Maney self-loading four-wheel scrapers, which have average records of 300 to 500 yards of dirt moved in a day.

A STEAM AND MOTOR ROLLER CATALOG

Catalog A, issued by the Buffalo-Springfield Roller Co., Springfield, O., has a great deal of information regarding all types and classes of steam and motor road rollers for road contractors.

CUTTING PIPE-LAYING COSTS

In the literature of the Central Foundry Co., 41 E. 42nd St., New York City, contractors will find much information of interest regarding Universal cast iron pipe, which has flexible iron to iron joints and requires no packing nor caulking.

TANKS FOR HEATING BITUMINOUS MATERIAL

The welded tanks and kettles built by Connery & Co., Inc., 4000 North Second St., Philadelphia, Pa., are described in detail in illustrated literature which may be secured free on request.

CUT DIRT-MOVING COSTS

In Catalog D 121, Smith & Sons Manufacturing Co., 1512 Guinotte Ave., Kansas City, Mo., tell how more pay dirt can be moved at less expense with the use of Roystrac multi-unit scrapers.

MAKING DIRT HUSTLE

Bulletin 111, which may be secured from the Thew Shovel Co., Lorain, O., tells how Thew shovels can be made to make dirt fly, at the lowest possible cost.

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

GASOLINE CRAWLERS CRANES

Contractors interested in a high-grade serviceable model crane should secure the bulletin of the Byers Machine Co., 480 Sycamore St., Ravenna, O., describing the new Byers gasoline crane with 60-horsepower, 4-cylinder motor, and crawler track.

DRAG-LINE CABLEWAY EXCAVATORS

A small-size drag-line cableway excavator for pit owners with a market for a hundred tons or less per day, is described in an illustrated booklet which may be secured from Sauerman Bros., 1143 Monadnock Bldg., Chicago, Ill.

ROCK DRILLS FOR TUNNELING

In Bulletin 70-S, the Sullivan Machinery Co., Chicago, Ill., describes the features of Sullivan DX-61 water hammer drills designed primarily for tunneling.

ALL KINDS OF SHOVELS AND SCOOPS

In a well-illustrated 61-page catalog, the Jackson Shovel Co., Montpelier, Ind., describes its complete line of plain-back, riveted-back and hollow-back shovels, scoops and spades.

A LOW-PRICED GRAVEL LOADER

A low-priced mechanical loader for gravel, crushed stone and other loose and heavy materials is described in a well-illustrated folder which may be secured from the Conant Machine Co., Concord Junction, Mass.

CONTRACTING FOR CLEAN WATER-MAINS

Any official interested in securing better pressure and cleaner water-mains without additional pumping equipment or installation of mains, may obtain the literature of the National Water Main Cleaning Co., Hudson Terminal Bldg., New York City.

CEMENT PRICES FOR EASTERN CONTRACTORS

The Pennsylvania Portland Cement Co., New York City, the only manufacturers of genuine "Pennsylvania" Portland cement, will quote prices on this cement to any Eastern contractors having concrete work in prospect.

A 5-TON HEAVY-DUTY TRUCK

Interesting information on 4-cylinder, 5-ton heavy-duty trucks for contracting work, may be secured by writing to the Autocar Co., Ardmore, Pa.

STRONG, WELL-BALANCED SHOVELS

There is a Pittsburgh shovel for every purpose, according to the manufacturers, the Pittsburgh Shovel Co., Oliver Bldg., Pittsburgh, Pa., from which a complete catalog and price list can be obtained.

THE CHLORINATION OF PUBLIC WATER-SUPPLIES

The Wallace & Tiernan Co., Newark, N. J., has some valuable literature on the value of chlorinating municipal water-supplies to prevent water-borne epidemics, which it will send free to interested officials on request.

DO YOUR WATER-MAINS LEAK?

The only way to be absolutely sure that your water-mains are tight and not wasting water, which it costs money to produce in its pure state, is to have a Pitometer survey made. Full details may be secured from the Pitometer Co., 52 Church St., New York City.

GRADER AND DRAG BLADES

Information regarding high-grade plow-steel grader and drag blades, as well as scarifier teeth, may be secured from the Shunk Mfg. Co., Bucyrus, O.

A PORTABLE WELDING OUTFIT

In a very educational and interesting booklet prepared for contractors under the title "Oxweld Can Do It," the Oxweld Acetylene Co., Newark, N. J., describes the many uses of Oxweld and also a portable generator, regulators and blowpipes with which every contractor should be well acquainted.

HEATING DEVICES FOR CONTRACTORS' JOBS

Oil-burning appliances for heating materials in all kinds of contracting work are described in detail in Bulletin No. 20, which may be secured from the Aerol Burner Co., Inc., 268 Hudson Ave., Union Hill, N. J.

PORTABLE PUMPS FOR CONCRETE ROAD WORK

Paving contractors will find much of interest regarding Barnes road builders' quadruplex pumps, built for carrying pressures as high as 500 pounds per square inch, in literature which may be secured from A. C. Saxe, Sales Mgr., The Barnes Mfg. Co., Mansfield, O.

A TRUCK FOR CLOSING VALVES

A new Bulletin 55-P, issued by Payne Dean, Ltd., 103 Park Ave., New York City, describes in detail a new truck chassis equipped with a valve-operating device driven by the engine, which materially facilitates the opening and closing of large water-works valves.

A CONCRETE MIXER CATALOG

The Jaeger Machine Co., 215 Dublin Ave., Columbus, O., has just issued a new well-illustrated 36-page catalog containing valuable details regarding the mixing and placing of concrete, in addition to descriptions of its various types of mixers.

A NEW INDUSTRIAL LOCOMOTIVE

A catalog describing the new "Minster" industrial locomotive may be secured from the Industrial Equipment Co., 910-916 Ohio St., Minster, O.

ASPHALT EXPANSION JOINTS

The Pioneer Asphalt Co., Lawrenceville, Ill., has just issued a 16-page illustrated booklet, describing the Pioneer expansion joint and showing the methods of using it in road construction.

HOW TO USE INTEGRAL WATERPROOFING

In the second edition of Booklet 134, the Truscon Laboratories, Detroit, Mich., describes in detail the "Science and Practice of Integral Waterproofing" as applied to basements, cement stucco, reservoirs, cisterns, tunnels, stand-pipes, foundations, subways and masonry structures of all kinds.

A NEW SHOVEL DIPPER

Circular Z-1, recently issued by the Bay City Dredge Works, Bay City, Mich., describes in detail the new non-clogging, positive-dumping, Type "Z" shovel dipper, which it is manufacturing in capacities from $\frac{1}{2}$ to 2 cubic yards.

A CONTRACTORS' ROAD TRACTOR

Two sizes of road tractors, 16-22 horse-power and 26-35 horse-power, with three forward speeds and one reverse, are described in detail in the literature of the Little Giant Co., 231 Rock St., Mankato, Minn.

A NEW ROAD REPAIR MATERIAL

Contractors and purchasing agents interested in a new bituminous road repairing material for taking care of cracks and joints in concrete roads, can secure full information from the Waring-Underwood Co., Commercial Trust Bldg., Philadelphia, Pa.

TIME-SAVING EXPANSION JOINTS

The Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, O., will gladly furnish to contractors and municipal officials free samples of Elastite, an integral expansion joint which combines eight operations in one.

METAL-WORK PAINT

Booklet 148 B, issued by the Joseph Dixon Crucible Co., Jersey City, N.J., tells of the advantages and uses of Dixon silica graphite paint, which has a 50-year reputation behind it.

A POWERFUL MACADAM ROLLER

The new Iroquois macadam roller of the vertical boiler type, having 50 per cent more heating surface in the boiler, larger engine cylinders and higher steam pressure, is described in detail in literature which may be secured from the Iroquois Sales Dept., the Barber Asphalt Co., Land Title Bldg., Philadelphia, Pa.

RIVET-CUTTING MACHINE

Booklet 259 issued by Schramm, Inc., Westchester, Pa., describes in detail the use of the compressed air rivet gun in dismantling steel structures and for other contracting service.

A TRENCHING MACHINERY BULLETIN

Pawling & Harnischfeger Co., 3819 National Ave., Milwaukee, Wis., will send to interested contractors a copy of its new 36-page trenching machinery bulletin, containing complete descriptions and data regarding wheel type excavators, ladder type excavators, back fillers, tampers, drag-lines and drainage equipment.

SOLVING MATERIAL-HANDLING PROBLEMS

In Catalog 105, the Weller Manufacturing Co., 1820-1856 North Kostner Ave., Chicago, Ill., describes in detail its apparatus suitable for the solving of contractors' material-handling problems.

SPEEDING UP DIRT-MOVING

Frequently contractors can dig dirt by machinery faster than they are able to remove it. The literature of the Cleveland Tractor Co., 19211 Euclid Ave., Cleveland, O., tells how Cletracs, which have the strength of six horses and are able to operate on all kinds of ground, help to get the dirt out of the way.

TRACTORS AND ROAD ROLLERS

The Huber tractor, which has plenty of reserve power and is able to turn with a grader on a 34-foot road-bed, and also the Huber road roller, which has spare power for hauling road machinery, are described in literature which may be secured from the Huber Mfg. Co., 803 Center St., Marion, O.

A NEW PAVER CATALOG

The T. L. Smith Co., 1016 32nd St., Milwaukee, Wis., has just issued a new catalog describing the advantages of Smith pavers for increasing contractors' profits in concrete road building.

A TRUSTWORTHY ENGINE FOR CONTRACTORS

The catalog of the Climax Engineering Co., 1 West 18th Ave., Clinton, Ia., tells of the use of Climax engines in all kinds of equipment for contractors.

A VERSATILE ROAD SHOVEL

In the literature of the Keystone Driller Co., Beaver Falls, Pa., contractors will find interesting descriptions of the Keystone traction steam shovel with its three different interchangeable scoops.

PAVING-GUARDS FOR CONCRETE ROADS

The W. S. Godwin Co., Baltimore, Md., will send to paving contractors, upon request, its literature describing steel paving-guards for protecting the edges of bituminous or concrete streets and roads.

STREET SPRINKLERS AND FLUSHERS

Full information and descriptive literature covering motor street flushers and sprinklers may be secured from the Municipal Supply Co., South Bend, Ind.

FIRE LINE METERS

Officials having to do with water-supplies will be interested in the literature of the Neptune Meter Co., 50 E. 42nd St., New York City, describing the Trident Protectus meter, which gives a full-size uninterrupted waterway for fire service.

RADIAL BRICK CHIMNEYS

The American Chimney Corp., of New York, 147 Fourth Ave., New York City, will send to any contractors or officials on request its complete catalog describing its special type of radial brick chimneys.

GRAVITY DUMP BODIES FOR ROAD TRUCKS

In Bulletin 120 E, the Heil Co., 1243 26th Ave., Milwaukee, Wis., describes in detail its line of gravity dump bodies for Ford trucks.

DISC AND TURBINE METERS

The special bulletins issued by the Badger Meter Mfg. Co., 841-847 30th St., Milwaukee, Wis., give full specifications and details regarding the construction and accuracy of Badger meters.

A LABOR-SAVING STONE SPREADER

How the Burch stone spreader saves 50 per cent in labor cost and 5 per cent in material in road construction, is described in literature which may be secured from the Burch Plow Works Co., 104 Bucyrus St., Crestline, O.

METER SETTINGS AND ACCESSORIES

The new price list of the Ford Meter Box Co., 414 S. Carroll St., Wabash, Ind., will interest those having prospective purchases of water-works appliances in view.

Legal Decisions in the Contracting Field

Edited by A. L. H. Street, Attorney-at-Law

Slight Defects in Building Construction Do Not Defeat Recovery by Contractor

The legal doctrine that a contractor will not be required to perform his agreement in strict compliance with its terms before being permitted to recover the contract price, less appropriate deductions to cover the expense of making the work strictly conform to the contract, was recently restated by the California District-Court of Appeal, in the case of Conrad vs. Foerst, 201 Pacific Reporter, 795. The Court said:

"It is true that it is held that one who has acted by virtue of a written contract has no right of recovery unless he can show that he has completed his contract or that completion had been waived or excused. This principle, however, has no application to the instant case. One of the provisions of the contract stipulated that should the owner or the architect at any time during the progress of the work request any alterations or deviations in the work provided for, either of them should be at liberty to do so, and that the same should in no manner affect the contract, but that the same should be held to be completed when the work was finished in accordance with the original plans as amended by such changes. There was a conflict in the evidence upon the subject as to the completion of the building according to the plans and specifications, but it is sufficient to support the finding of the trial court that the changes or omissions complained of were either ordered by the architect or were trivial in character. A contractor who has substantially performed his contract will not be held to have forfeited his right to recovery by reason of trivial defects or imperfections in the work performed. . . . What constitutes 'trivial imperfections' is a question of fact in each case, and the decision of the trial court upon proper evidence cannot be reviewed here."

Obligations of Owner Concerning Payments

Where, by the terms of a contract for the construction of a building, it is provided that payments shall be made upon estimates made by the architects in charge as the work progresses, an estimate so made does not create any absolute liability upon the owner to pay the same, either to the contractor or his assignee, if the contract provides that he may retain any amount which may become due and payable to the contractor for the satisfaction of liens or claims of laborers or materialmen which may be asserted against him or the building; it appearing that at the time such estimate was given there were

then claims which might be made valid liens against the building largely in excess of the amount of the estimate.

An order given by a building contractor to a third person, and accepted by the owner of the building, directing him to pay such third person all moneys which may thereafter become due to such contractor under the terms of the building contract, imposes no obligation upon the owner of such building to pay anything upon such order, unless there remains some amount payable under the terms of the contract after discharging all liens or claims for labor and material upon the building, where, by the terms of such contract, the owner has the right to withhold any moneys payable thereunder for the purpose of discharging such liens or claims. (West Virginia Supreme Court of Appeals, Twentieth Street Bank vs. Summers, 110 Southern Reporter, 478.)

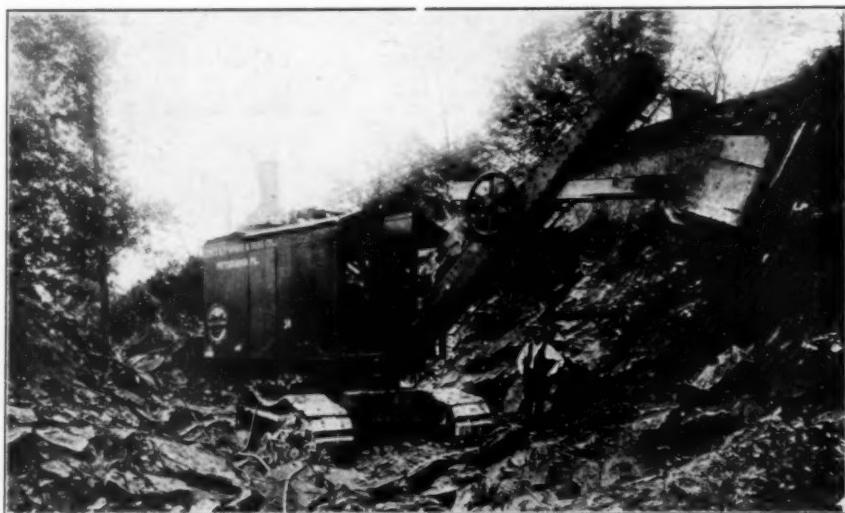
Validity of Verbal Promise to Pay Debt

In nearly every state, if not all, there is a statutory provision in force to the effect that a promise to pay the debt of a third person is not valid unless evidenced by a signed promise in writing. But it is generally recognized that this rule does not apply where credit is primarily extended by the creditor to the promisor in the first instance, or where the debtor is released at the promisor's instance. This latter exception is illustrated by the opinion of the Massachusetts Supreme Judicial Court in the late case of Pope & Cottle Co. vs. Wheelwright, 133 Northeastern Reporter, 106. It is decided that where an owner promises to pay a contractor's indebtedness to a materialman, as a consideration for release of the contractor from liability, the promise is valid although not reduced to writing.

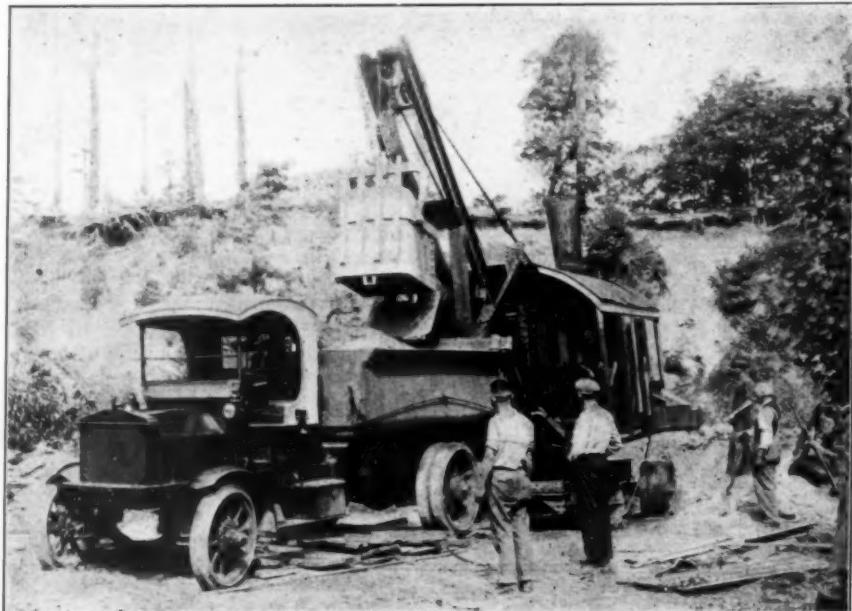
Contractors Must Protect Street Excavations

In the recent case of Gomez vs. Town of Flagstaff et al., 202 Pacific Reporter, 401, the Arizona Supreme Court passed on questions pertaining to the liability of sewer contractors for death of a child drowned on falling into an excavation concealed through filling with water. It is decided that there was no liability if negligence of the child's accompanying father was the direct cause of the accident. But concerning the contractors' duty the Court holds that they were primarily under legal duty to minimize as much as possible the dangers to pedestrians and other travelers along the street, by erecting suitable warning, or by covering the opening, or by taking some other suitable method of preventing persons from falling into it.

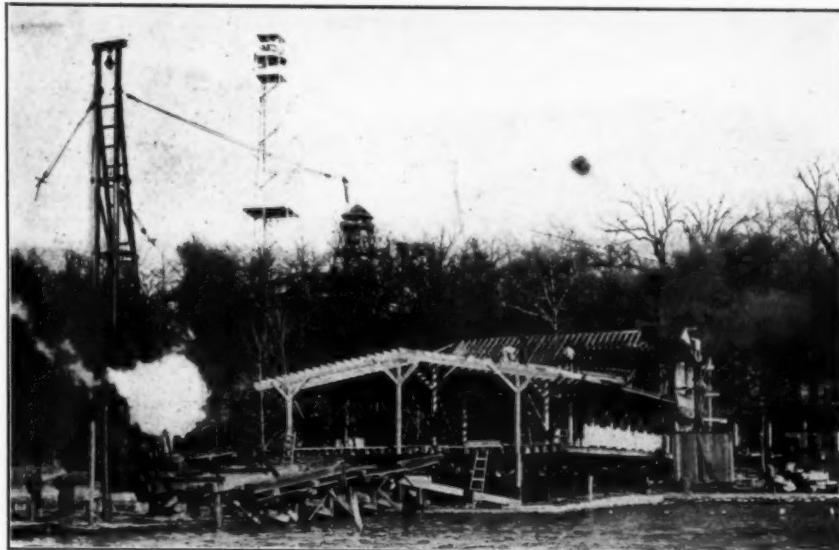
Steam Shovels in Service



A MARION TRACTION TREAD STEAM SHOVEL HANDLING A FULL LOAD IN A RAVINE

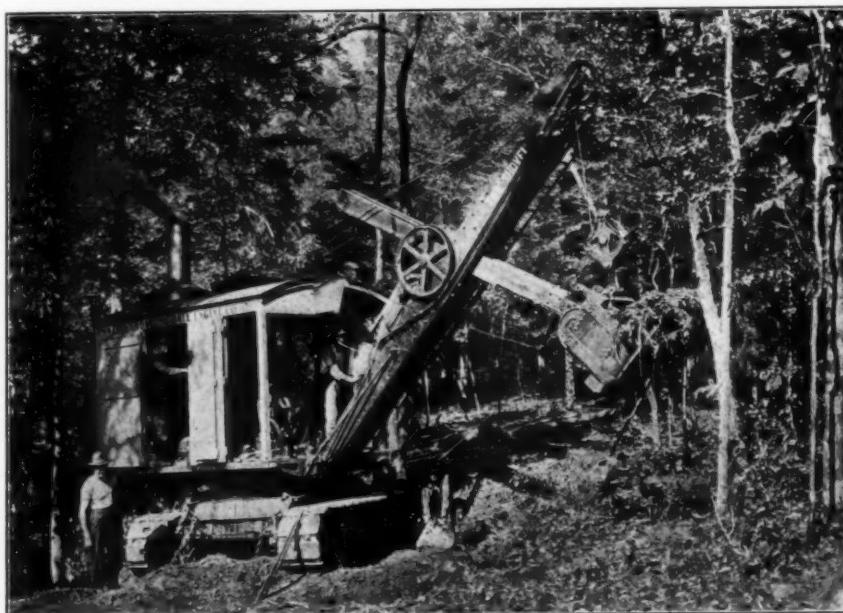


A FLEET OF FEDERALS WAS KEPT BUSY BY THIS STEAM SHOVEL ON A NEW ROAD JOB
IN ANDOVER, MASS.



A UNION STEAM HAMMER DRIVING PILING FOR NEW DANCE HALL
AT CREVE COEUR LAKE, MO.

This pile hammer was sold by the George F. Smith Company, St. Louis, Mo.



AN ERIE STEAM SHOVEL HANDLING DIFFICULT MATERIAL

This outfit was sold by Henry C. Ashmead, Birmingham, Ala., to the Alabama Power Company, for use in connection with the construction of the Mitchell Dam hydro-electric development on the Coosa River in Alabama.

A New Industrial Locomotive for Road Work

A NEW model, "F," 7-ton industrial locomotive has recently been placed in the market by the Industrial Equipment Company, Minster, O., formerly the Cummings Machine Company. In addition to being of a new size or capacity, this locomotive is claimed to have a number of new special features. There has been no change in the method of transmitting power from the engine to the wheels, as the new model is of the friction and chain-drive type. This method of transportation has been successfully used in Cummings locomotives for the past five years.

This locomotive is of all-steel, box girder construction frame, and has special high manganese chrome alloy steel in the axles, jack-shaft, and friction disc shaft, and Carnegie rolled steel wheels. A Buda engine is used, Westinghouse starting and lighting outfit, Stromberg carburetor, Duplex governor, Split-dorf Aero model magneto with enclosed impulse automatic starter, Hyatt roller bearings, New Departure ball bearings, Willard storage battery and Diamond roller chain.

To insure maximum transmission of power and proper alignment of all working parts, the engine drive disc assembly forms one complete unit with a two-point suspension. A large number of parts have been eliminated by changing the method of braking. When the brake is applied, two heavy iron shoes diametrically opposite grip a steel brake wheel on the jack-shaft. This method is very efficient, and with a pressure of approximately 25 pounds it is possible to lock the wheels.

Another special feature is the stationary hand-wheel method of shifting the fiber wheel across the face of the disc in order to get forward, reverse or a change in speeds. The locomotive has a large, roomy and comfortable cab, in which all control levers are conveniently located. To insure easy and quick starting and battery insurance, a primer is attached to the engine manifold, manually operated from the cab. As a signal, the Fulton exhaust whistle is used.

The Industrial Equipment Company has



THE NEW MINSTER INDUSTRIAL LOCOMOTIVE

adopted the trade name of "Minster" for this locomotive, since changing to its new corporate name.

Ballard Moves Offices

On June 1, F. W. Ballard & Company, Consulting Engineers, Swetland Building, Cleveland, Ohio, will move to more commodious offices on the seventh floor of the Bulkley Building, Cleveland.

Contractors Profit Tied Up

Many a contractor who made a fair or good profit in the past two years has most of it invested in second-hand equipment, and he must either take a loss in its sale or continue with the same methods in competition with newer and more up-to-date equipment. Many contractors with large, expensive layouts are finding this out with the keen competition present this year in highway lettings. In selecting new equipment a contractor might well afford to first determine upon seeking work of certain kinds and buy his equipment accordingly.

New Salesmen for Black & Decker

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md., has recently announced that C. M. Hall has become associated with that organization and will have the territory of Indiana, Kentucky, and the corner of Ohio which includes Cincinnati and Dayton. His headquarters are in Indianapolis. Mr. Hall was formerly in charge of the New York territory for the Dodge Transmission Company.

Announcement is also made that Malcolm Grant, whose former experience has been largely in efficiency and time study work in automotive factories, has joined the Black & Decker organization in a selling capacity and will have the state of Ohio, except the corner which includes Cincinnati and Dayton. Mr. Grant's headquarters will be at the Black & Decker branch office, 2030 East 22d Street, Cleveland, Ohio.



ONE OF 17 LOCOMOTIVES ON A ROAD JOB IN MONTANA



"PENNSYLVANIA" CEMENT

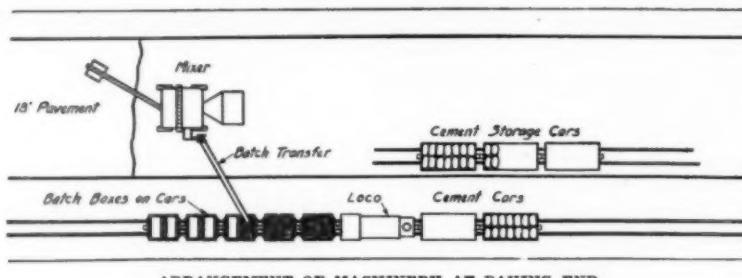
IS MANUFACTURED SOLELY BY THE
**PENNSYLVANIA
CEMENT CO.**

IT HAS A PICTURE OF
WILLIAM PENN ON EVERY BAG
REMEMBER: NO OTHER COMPANY
MANUFACTURES GENUINE
**"PENNSYLVANIA"
PORTLAND CEMENT**

SALES OFFICES:

NEW YORK
BOSTON

PHILADELPHIA
BUFFALO



Concrete Road-Building Equipment

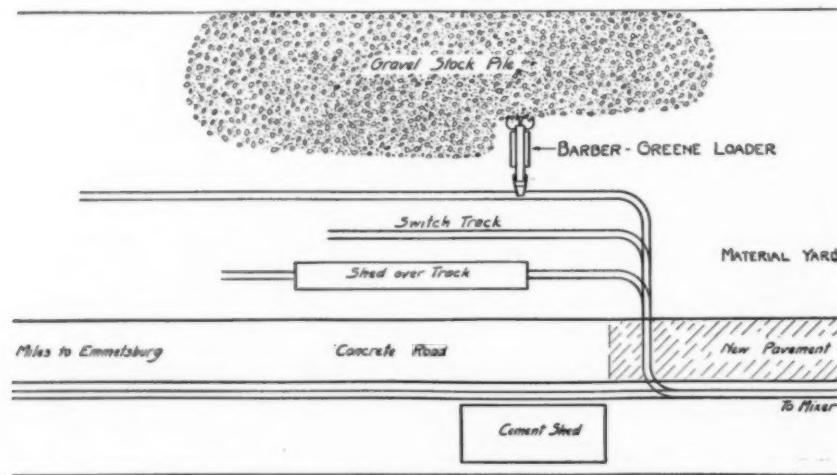
Use of a Loader with Industrial Equipment at Pit and Central Storage Pile

ON the Emmetsburg-Mallard Road, in Palo Alto County, Iowa, Brereton & Bauck of Emmetsburg, Iowa, built 11.05 miles of 18-foot concrete pavement 8 inches thick at the center and 7 inches at the edge, using a 1:2:3½ mix and a 6-bag batch. The average daily pour for 10 hours was 1,092 square yards, or 232 cubic yards, this making a batch every 2 minutes. The maximum daily pour in 10 hours was 1,346 square yards, or 285 cubic yards, this being a batch every 1 minute and 38 seconds.

The job extended from Emmetsburg on the north to Mallard on the south. It was let in 1920, but because of the switchmen's strike, which delayed delivery of the equipment, only 2 miles was built south of Emmetsburg that year. The pit-run gravel for the work was

mined with a drag-line outfit by the county forces, about 1¼ miles west and 1 mile south of Emmetsburg. The first 6 miles of pavement was laid by hauling direct from this gravel pit to the paver, a Barber-Greene loader being used to load the gravel from the stock pile to batch boxes on industrial cars.

During the winter of 1920-1921, gravel was hauled from the pit at the river to form a stock pile at a point 6 miles south of Emmetsburg. The gravel was loaded into the batch boxes with the same loader, was hauled the 6 miles with industrial equipment to where a small crane, which was rented, raised the batch boxes and dumped them to form a pile 250 feet x 115 feet x 13 feet, containing approximately 14,000 cubic yards.



A New Catalog for You

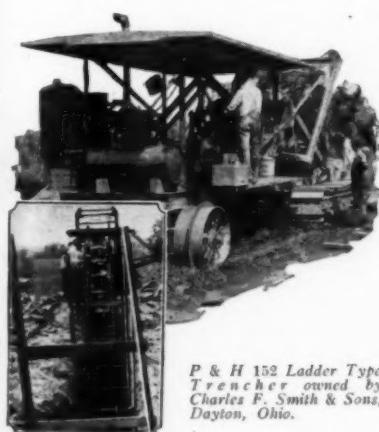
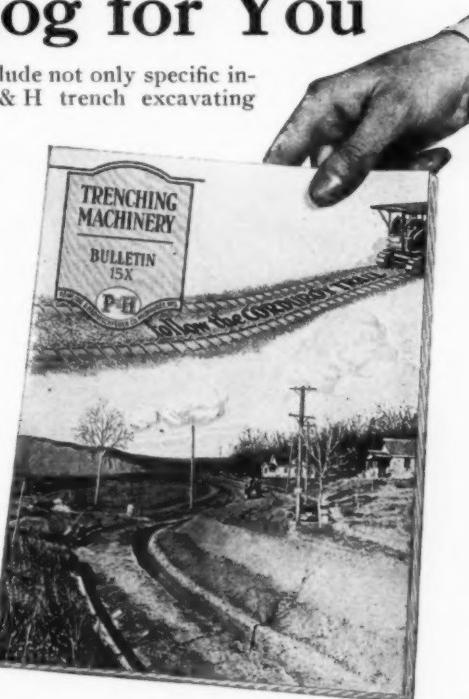
The 36 pages of this new Bulletin include not only specific information on the complete line of P & H trench excavating machinery but contain many illustrations and descriptions of these machines at work in various parts of the country. These include:

**Wheel Type Excavator,
Ladder Type Excavator,
Backfiller, Tamper,
Dragline, and
Drainage Equipment.**

The unusual results obtained through use of P & H equipment—the speed—the long service at low operating cost, are a result of the high quality of design, material and workmanship.

What has actually been accomplished as recorded in this Bulletin is of interest to every contractor and public service company.

A request will bring a copy by return mail. The coupon is for your convenience—use it.



P & H 152 Ladder Type
Trencher owned by
Charles F. Smith & Sons,
Dayton, Ohio.

Excavating Machinery Division
PAWLING & HARNISCHFEGER CO.

Established in 1884.

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LOADING THE BATCH BOXES ON INDUSTRIAL CARS FROM STOCK PILE

When the 1921 paving season opened, gravel loader could discharge 22 feet from the pile to continued to be hauled from the river to the the batch boxes. On the average, 20 batches stock pile until the mid-point of the job had were loaded by the mechanical loader in 20 been passed by the mixer. At this time the minutes. The necessary track moving was done loader was moved to the newly formed stock by the loading crew when they were not busy pile, the track to the river pit was taken up, and otherwise, and required remarkably little time. the paving operation was continued from the Four men with bars moved 100 feet of track 10 new starting point. The plan of operation on feet sideways in 10 minutes.

This section of the project was as follows: The loader with swivel spout was used to load the gravel from the stock pile into batch boxes on industrial cars. Each car had 2 batches of 22 feet per batch, and each train consisted of 10 cars, or 20 batches. Cars were dropped into position by hand, two men doing that and the clean-up necessary around the loader. The

Cement was hauled from Emmetsburg to the stock pile by small trucks with trailers, each truck and trailer carrying about 100 sacks per trip and averaging about 10 trips per day. The haul was over the finished section of the concrete road, having very flat grades. A small shed with a capacity of 250 barrels was built at the end of the pavement, and when cement was



METHOD OF STORING CEMENT AT THE MIXER



Our small size machines are making money for the pit owner with a market for 100 tons or less per day, just as our larger installations are for the car-load gravel shipper. Write for our illustrated booklet.

SAUERMAN BROS.
1143 Monadnock Bldg., Chicago



SAUERMAN DRAGLINE CABLEWAY EXCAVATORS
dig, convey, elevate and dump in one operation



LITTLE GIANT
Road Tractor
The Packard of
The Tractor
World

Three forward speeds and one reverse. Spring mounted front and rear. All working parts completely enclosed. Great power and extremely light weight. Material and workmanship compare favorably with best motor truck made. Two sizes—Model B, 16-22 H. P.; Model A, 26-33 H. P.

LITTLE GIANT COMPANY
231 ROCK STREET
MANKATO, MINN., U. S. A.
Established 1876

Repair Your Streets with
THE LUTZ SURFACE HEATER

It softens asphalt and other bituminous pavements. It vulcanizes the old and new material into a perfect bond. It cements Asphalt on Granite, Brick, Cobble, or other hard pavements. It makes re-surfacing and maintenance easy and inexpensive

Illustrated Particulars on Request

Equitable Asphalt Maintenance Co.
1901 Campbell St.
Kansas City, Mo.



Repairing an Asphalt Pavement, New York

Keystone Driller Company

170 Broadway, New York • Monadnock Bldg., Chicago • Joplin, Mo.
Beaver Falls, Pa.



Model 4. 14-ton All Steel Excavator with 1/4 yard Skinner.

AMERICAN CHIMNEY CORPORATION of New York

Designers and Builders Radial Brick Chimneys

May we send you our Catalogue?

Main Office: 147 Fourth Avenue, New York

BRANCHES: Chicago: 1101 Security Building. Cleveland: 319 American Trust Building. Philadelphia: Stephen Girard Building. Boston: 147 Milk Street.



WHY
WASTE
YOUR
PROFITS?

The only way to secure real profits on road construction is to push the work through quickly without idle time. One way to prevent loss of profits is to use the

BURCH STONE SPREADER

For slag, stone or gravel, attached to the end of the truck, it will deposit material at required depth and width at half the cost of men, and pay for itself in a mile.

Let us tell you what other contractors have learned about it

THE BURCH PLOW WORKS CO., 105 Bucyrus St., Crestline, Ohio

WOLVERINE MIXERS



A Knickerbocker Product

¶ The Wolverine Concrete Mixers successfully fill a big need right now, both in the building field and in the construction of sidewalks, bridges and culverts, for a well made, low priced mixer.

¶ The special design of these mixers, together with the quantity built, permits us to make them the desired weight for portability, and of sufficient strength to withstand the hard work they are subjected to on the job, and still sell them at exceedingly low prices.

THE KNICKERBOCKER CO., 338 Liberty St., JACKSON, MICH., U. S. A.
Knickerbocker Line of Concrete Mixers, Mortar Mixers, Portable Saw Rigs

not being loaded directly from the trucks to the small flat cars on the industrial track it was stored in this shed. Two flat cars with 60 sacks of cement each were in each train, the cement ahead of the locomotive and the batch of gravel behind it.

At the mixer the cement was transferred to other cars, carried on light 24-inch-gage track, and laid on the subgrade between the forms. The batches of gravel were dumped into the mixer skip by means of the familiar type of batch transfer. Cement was put into the skip by hand.

A crew of 21 men handled the loading and the hauling of material as follows:

1	Barber-Greene loader operator
2	men to switch cars and clean up
2	men to load cement at shed
1	material yard foreman
3	cement car unloaders
2	cement truck drivers

1	loader spout man
4	locomotive engineers
4	locomotive firemen
1	trackman

21 total

A crew of 27 men handled the mixing, placing, etc., as follows:

2	men to handle bail and batch boxes
2	men to spread wet concrete
1	batch transfer derrick man
1	machine tamper operator
1	steam pump man
1	man to sprinkle
3	men to cover concrete
1	man finish-edger
1	mixer engineer
1	mixer fireman
2	men to charge cement
1	man to cut sacks, etc.
2	men on forms
7	men fine grade
1	roller man

27 total

A Road Truck with Four-Wheel Drive

AMONG the recent developments in motor trucks particularly designed for highway work is the new Road Builder truck which has been placed on the market by the Four Wheel Drive Auto Company, Clintonville, Wis., the manufacturers of FWD trucks. This truck has an unusually short wheel-base for one of this type—only 105 inches long. This gives a short turning radius, making it useful as a time-saver in turning around on narrow grades or rights of way, without the difficulties often encountered by trucks of the long wheel-base type.

The truck carries a three-compartment body of 3 tons capacity. The body is operated by a horizontal hydraulic hoist, and the tail-gates are operated individually. This truck may also be used as a tractor for trailing loads to the concrete mixer or for hauling road machines.



A ROAD BUILDER'S THREE-COMPARTMENT TRUCK WITH DRIVE ON ALL FOUR WHEELS

COMMERCIAL REGISTER OF THE UNITED STATES

30th Edition, S. E. Hendricks Co., Inc., New York City. 2,324 pp. \$12.50.
Published in the standard size of 8½ x 11½ inches, Hendricks' Commercial Register is even

more valuable than before. Its lists completely cover the electrical, engineering, machinery, building, manufacturing, chemical and similar industries. This book is comprehensive, well arranged and thoroughly indexed for instant reference, and is an invaluable guide in purchasing and selling.



"PIONEER"



Expansion Joint

Every monolithic pavement should have an Expansion Joint. They are placed to take care of expansion and contraction. "PIONEER" Expansion Joint is produced from an absolutely pure asphalt, giving maximum efficiency. Specified, recommended and used by engineers and contractors who take pride in their work and still believe in quality.

"PIONEER"

Filler Asphalt

The highest quality of asphalt filler produced. Makes ideal brick pavements. Low prices and immediate delivery on any quantity. Made to meet the strictest filler specifications.

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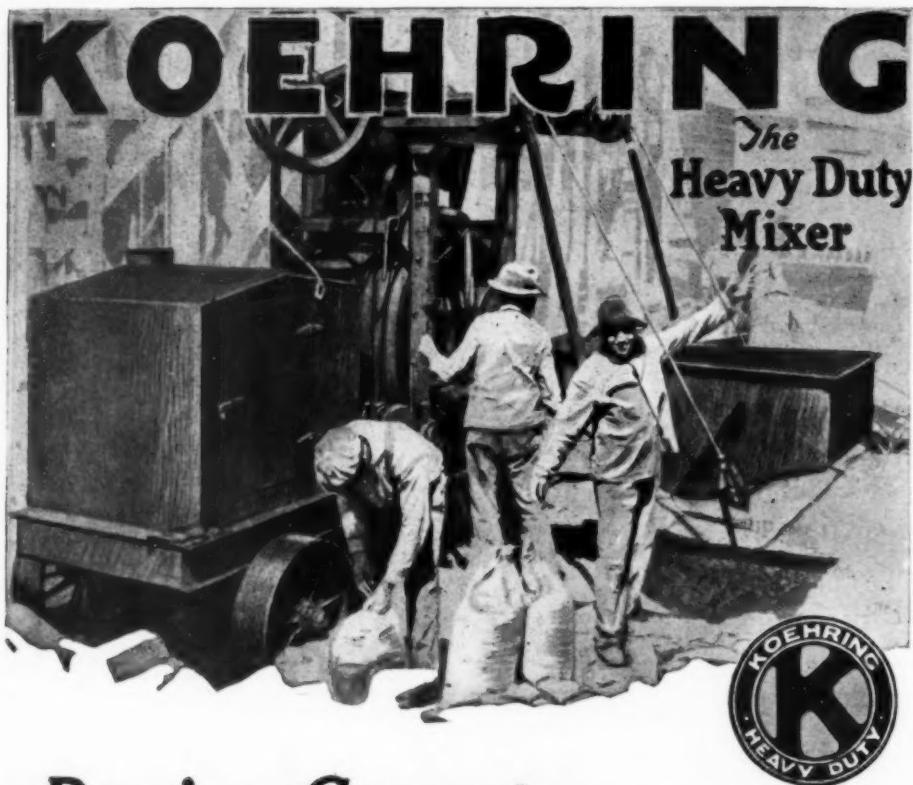
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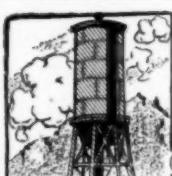
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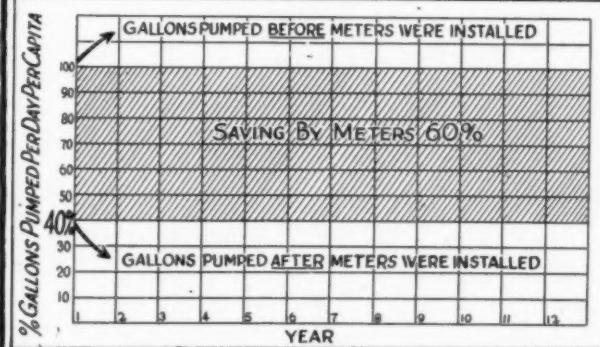
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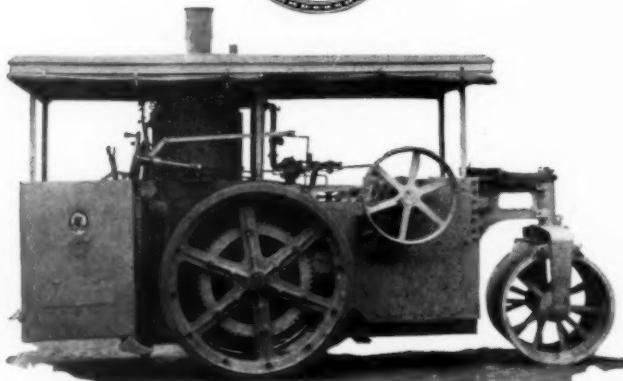
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